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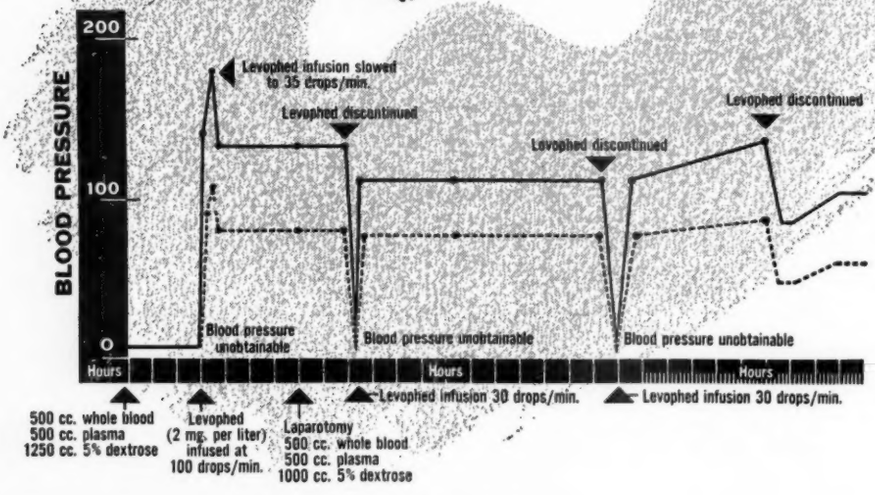

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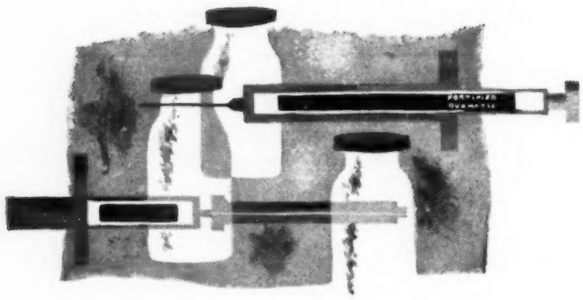

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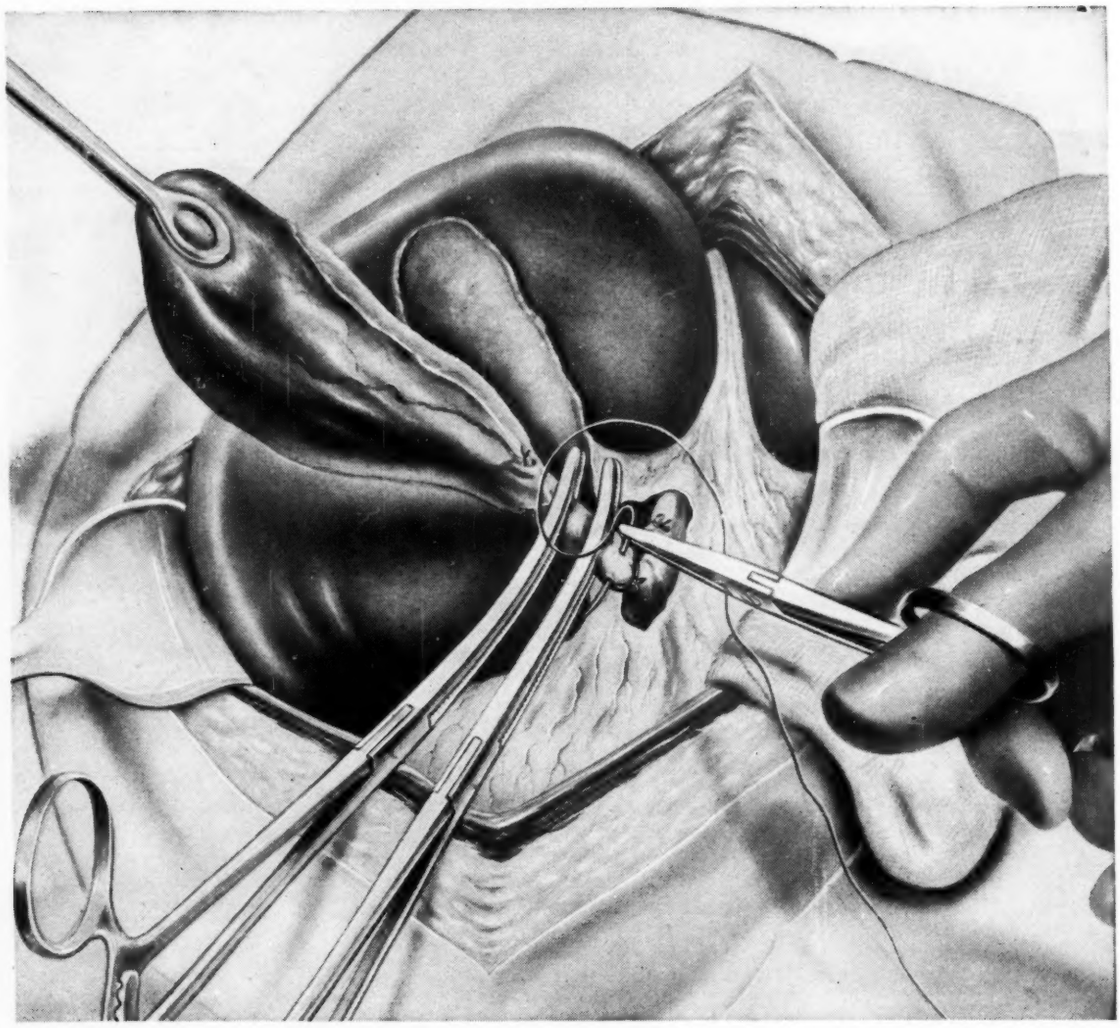

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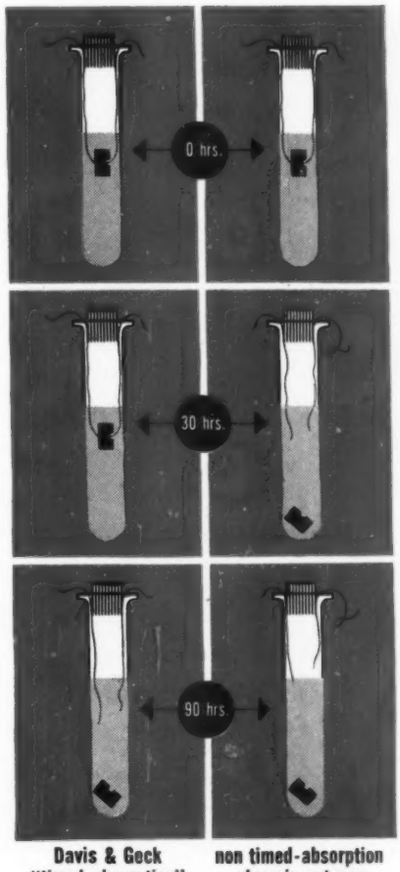

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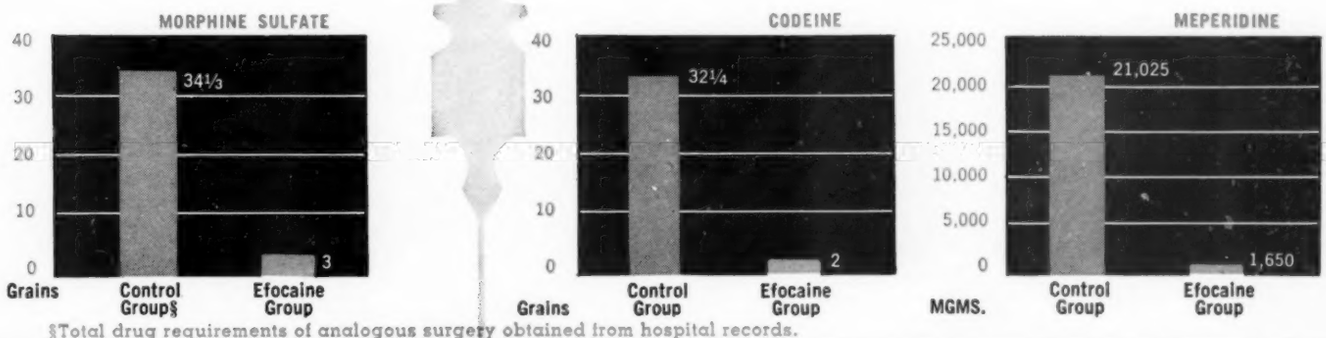

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‡Iason, A. H., and Shaftel, H. E.: A New Approach to the Problem of Postoperative Pain, Am. J. Surg. 83, (April) 1952.

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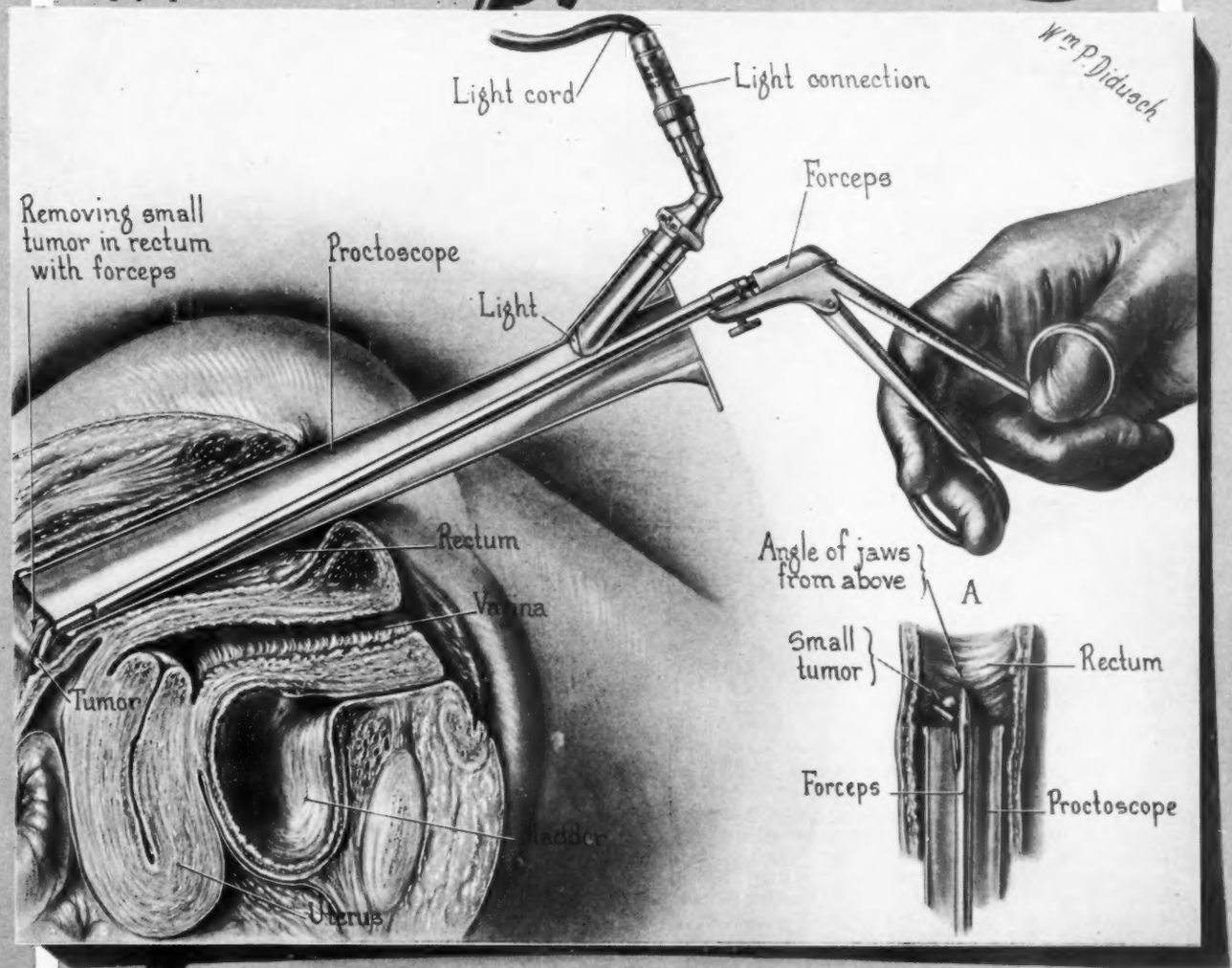

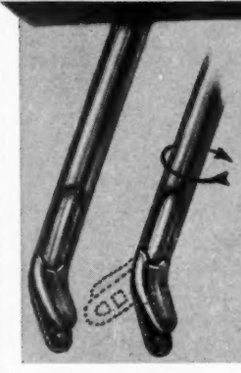

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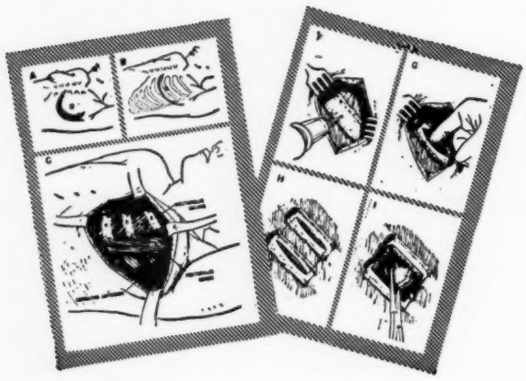

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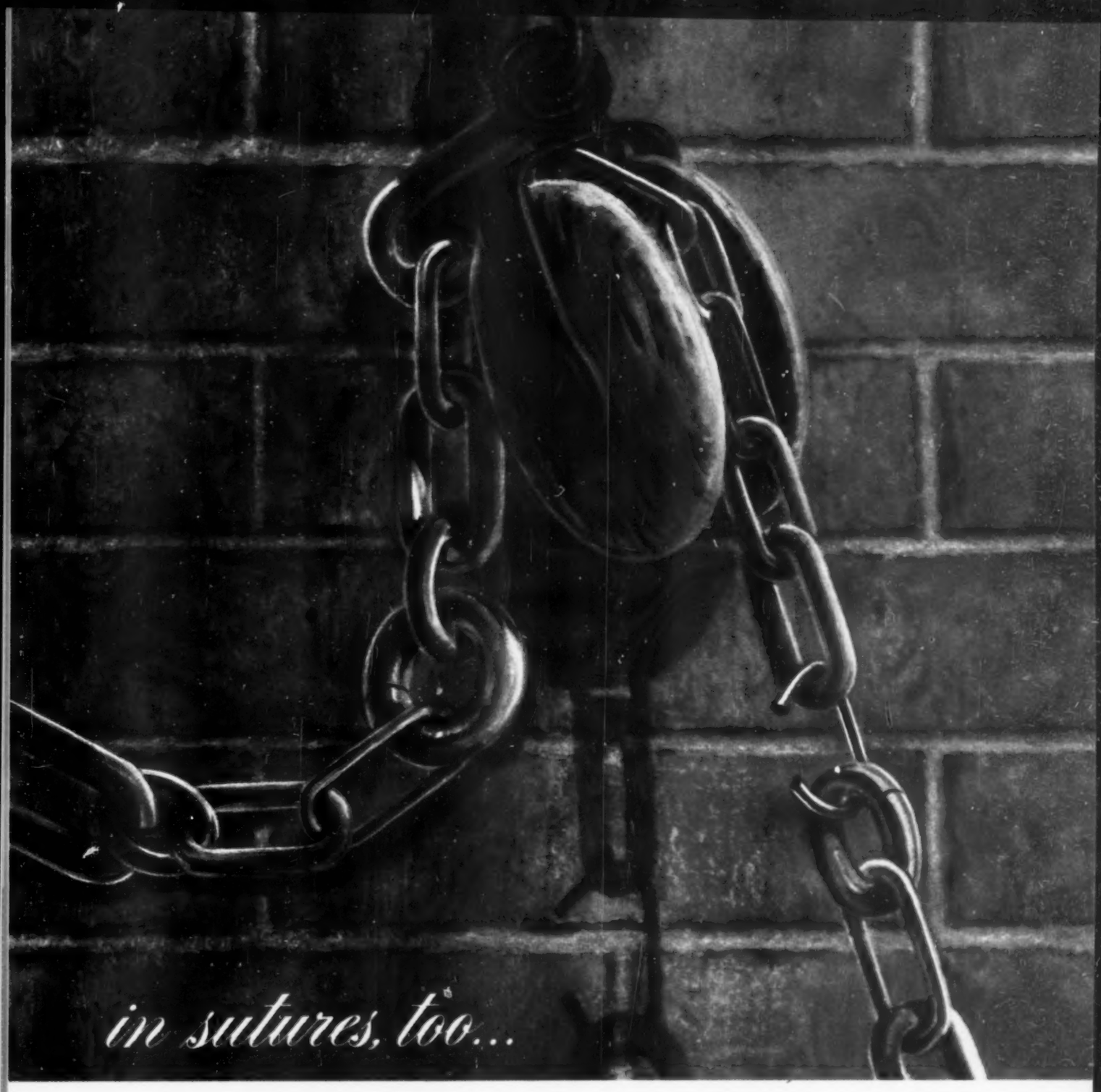

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minimizes foreign body irritation after the wound is healed

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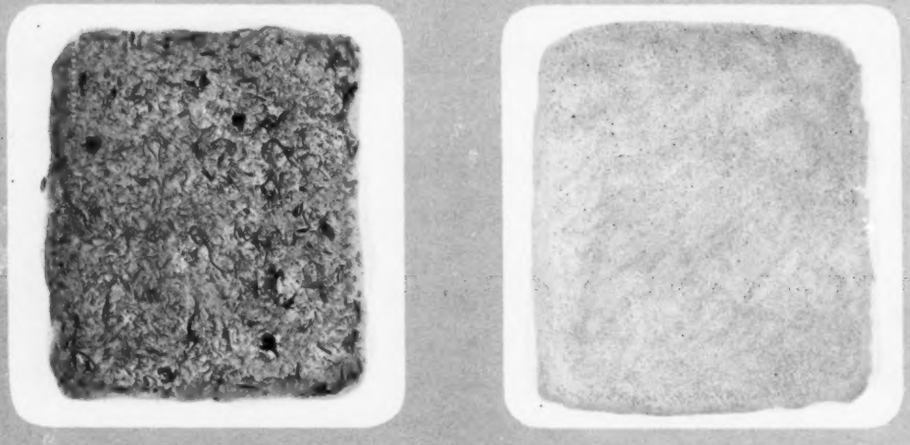
YOU COULD MAKE THIS SIMPLE TEST

Loops of gut were tied around a glass tube and immersed in 1% trypsin solution. After 200 hours (comparable to 6 months in tissue) the residue was spread on glass plates. Note the difference.



1. Ordinary surface chromicizing shows residue of undigested knots and suture fragments.

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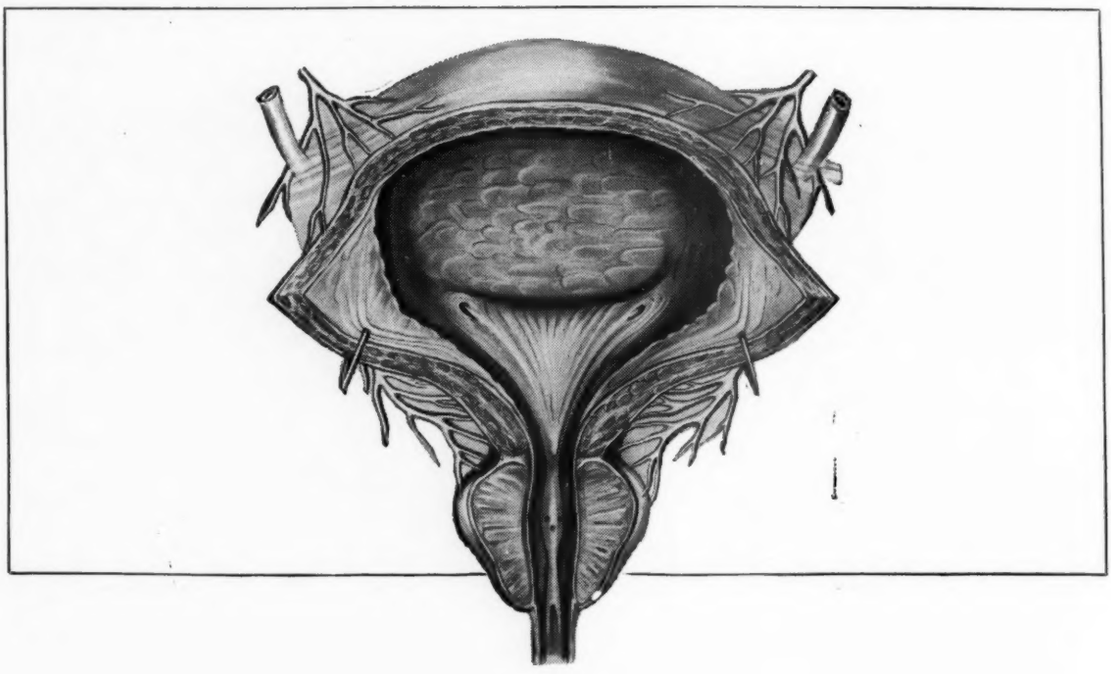

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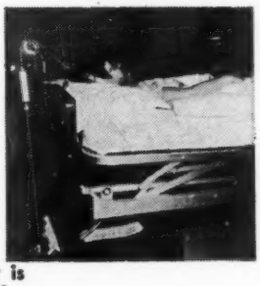

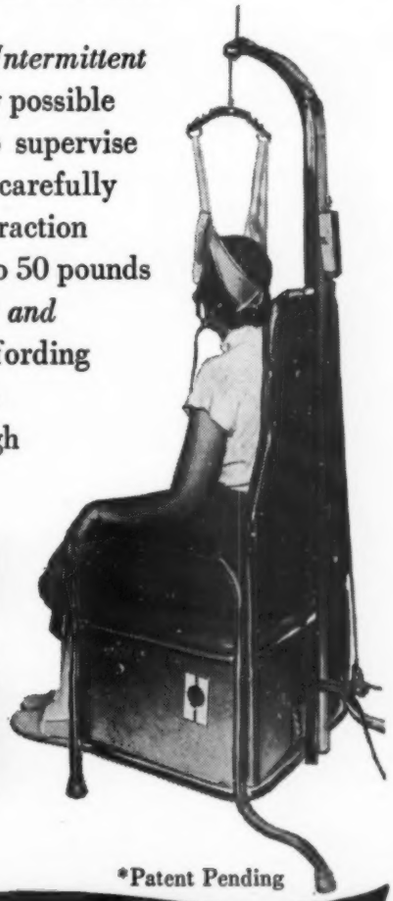

The *Motorized Intermittent Tractolator* is also available as a bed apparatus for cervical and lumbar traction. Details on request.

*Patent Pending

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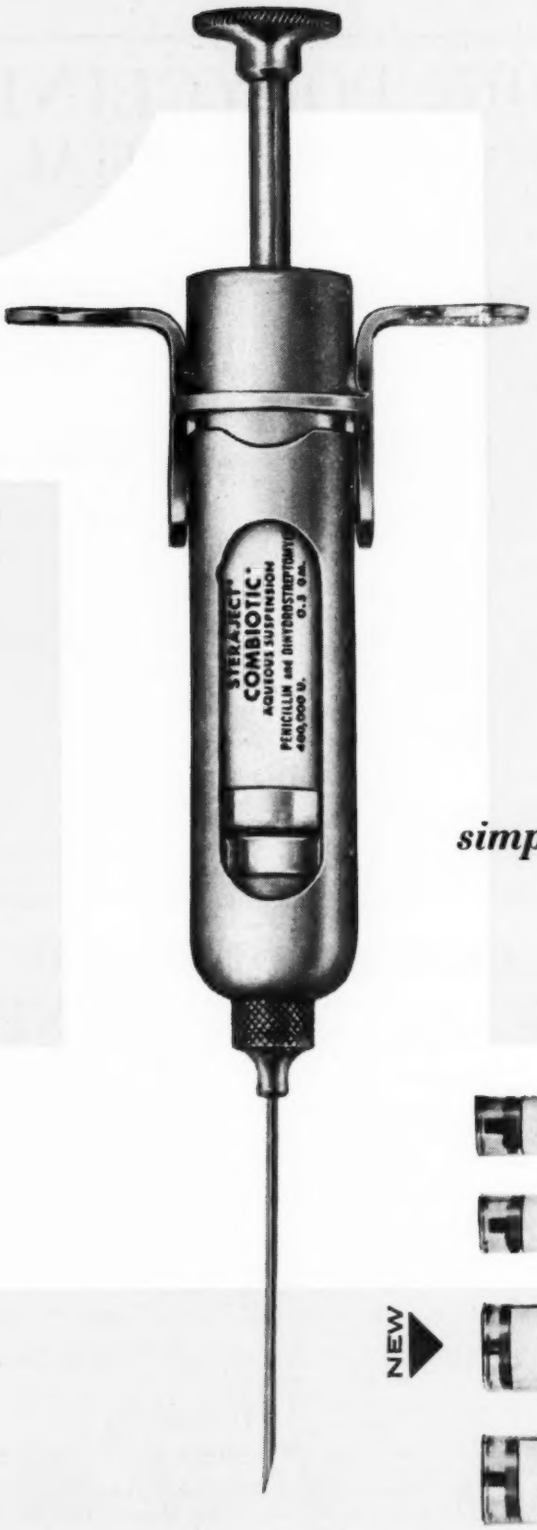

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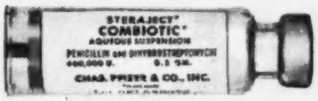

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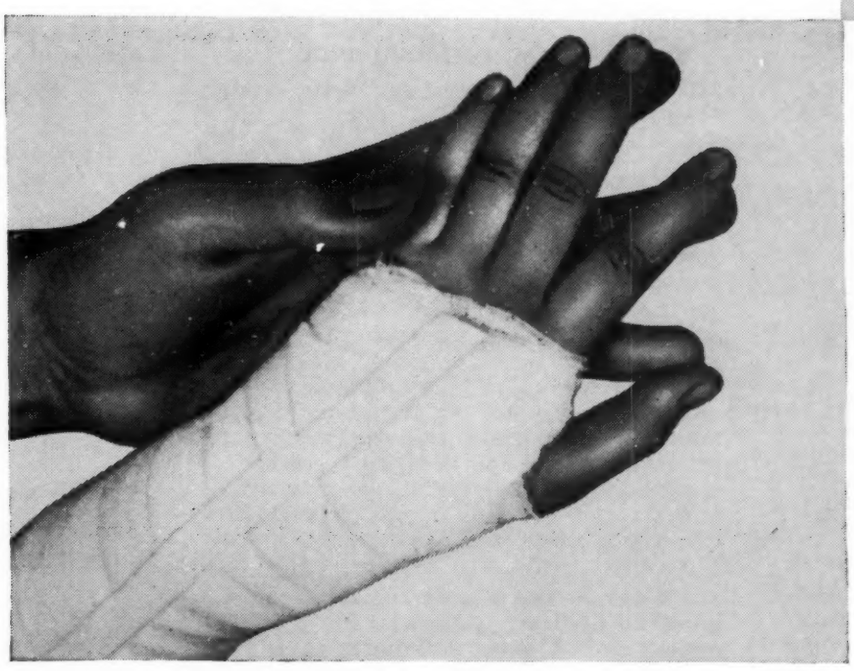

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1. Gordon, R. A., and Morton, M. V.: Anesthesiology 12:680 (Nov.) 1951.

2. Smith, G.: GP 5:61 (Apr.) 1952.

3. Pickrell, K. L.; Stephen, C. R.; Broadbent, T. R.; Masters, F. W., and Georgiade, N. G.: In Press.

effective, well-tolerated, esthetically pleasing

a two-year clinical study of a contraceptive gel used without a diaphragm

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†Hunter, G. Wilson; Darner, C. B., and Gillam, J. S.: A Method of Contraception Without Diaphragm — A Two-Year Investigation. World Population Problems and Birth Control, Ann. New York Acad. Sc. 54:825, 1952.

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*McLane, C. M.: Am. J. Obst. & Gynec. 57:1018, 1949.

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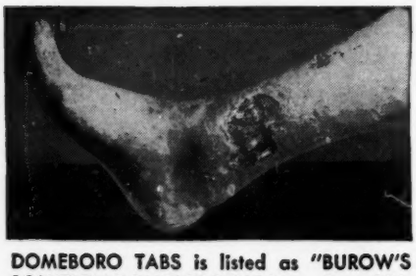

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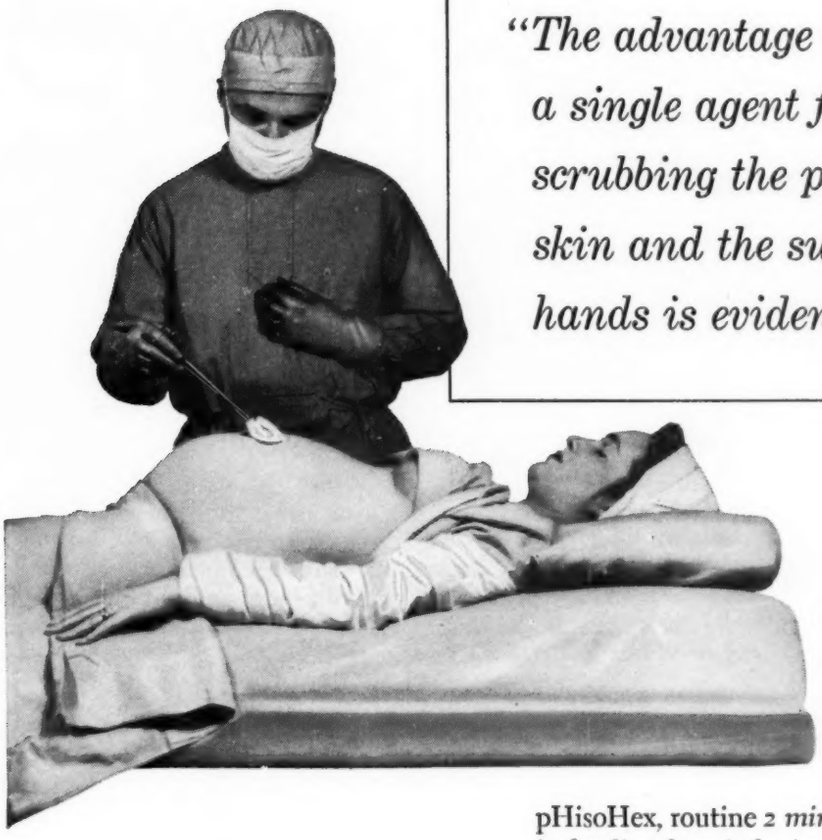

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1. Artz, C. P., Pulaski, E. J., and Shaeffer, J. R.: *U. S. Armed Forces Med. Jour.*, 2: 819, May, 1951.

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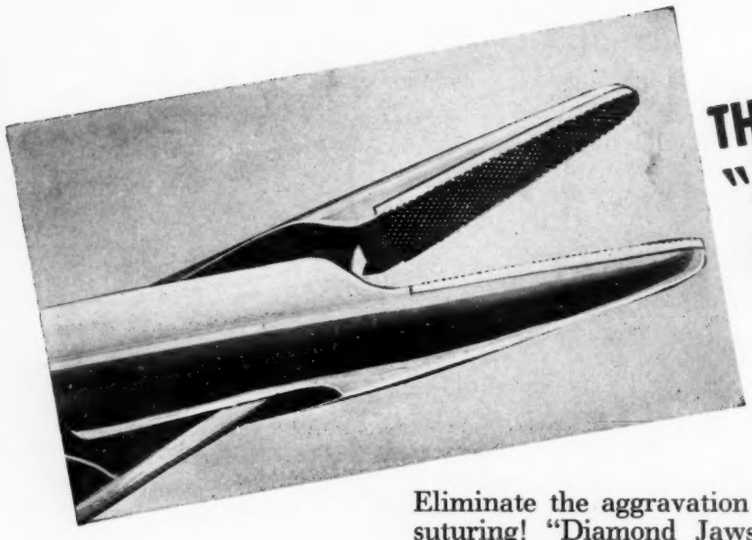

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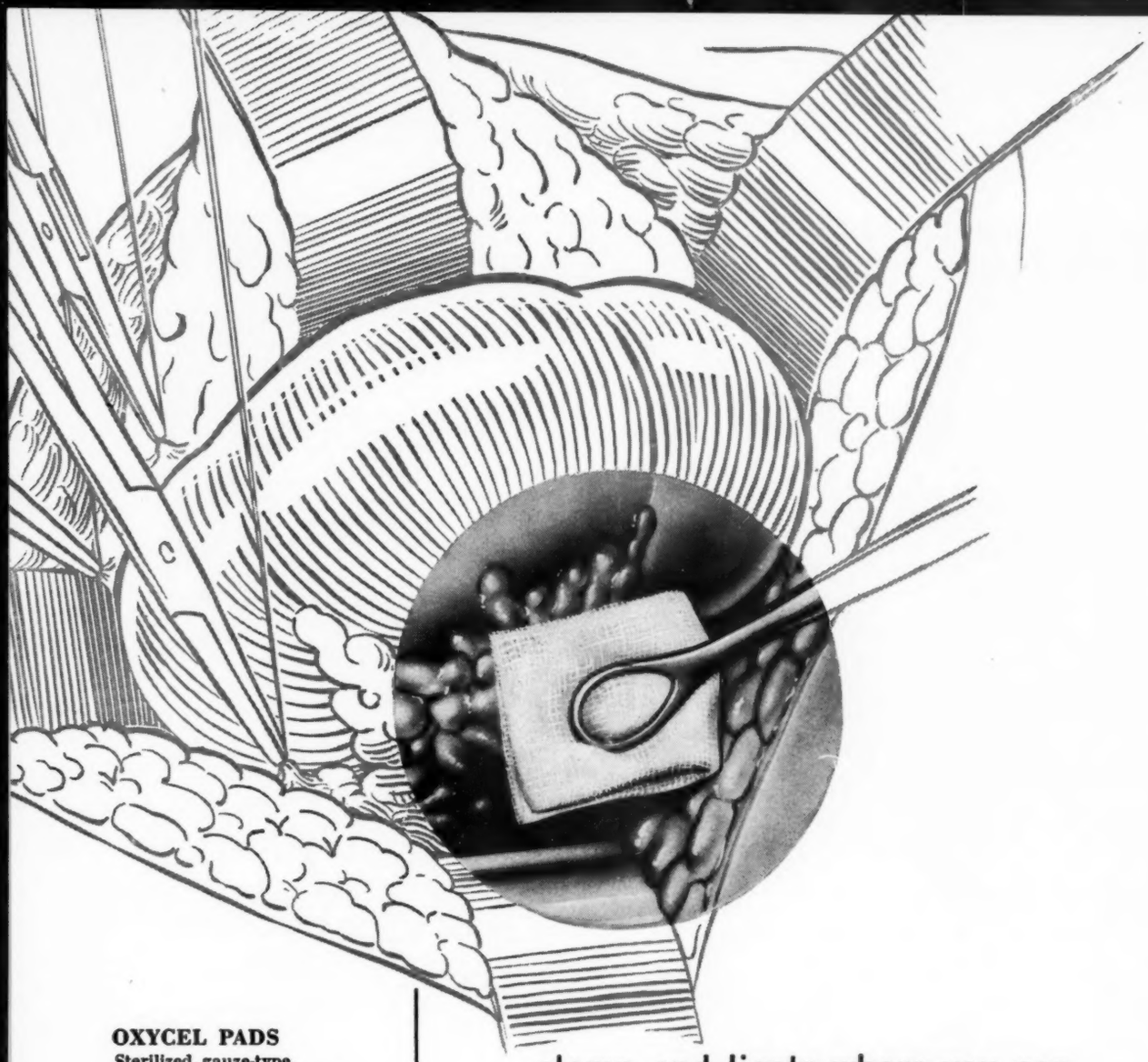

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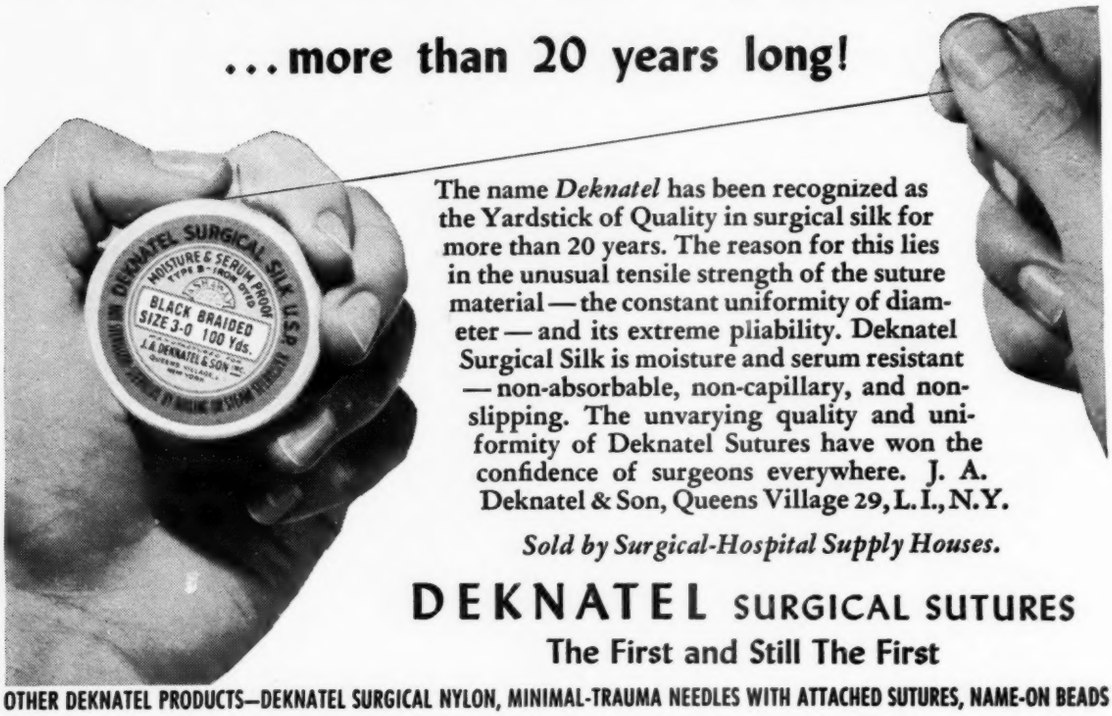

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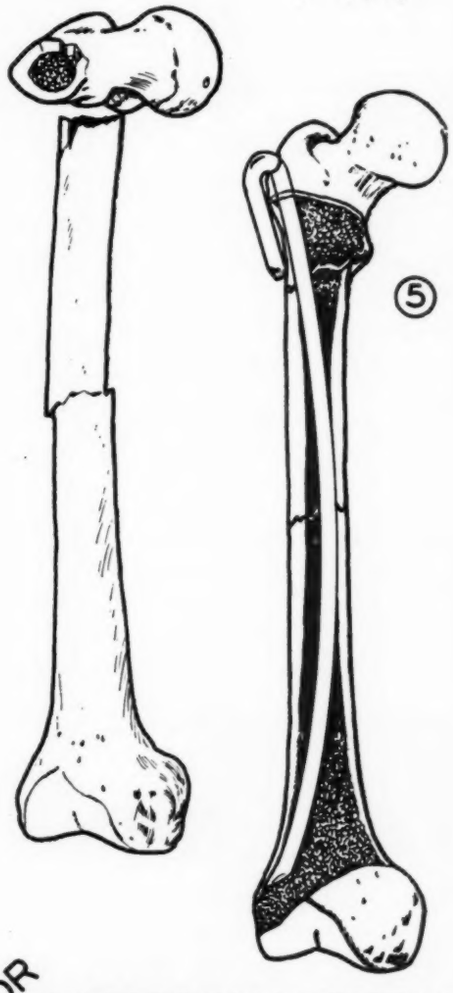

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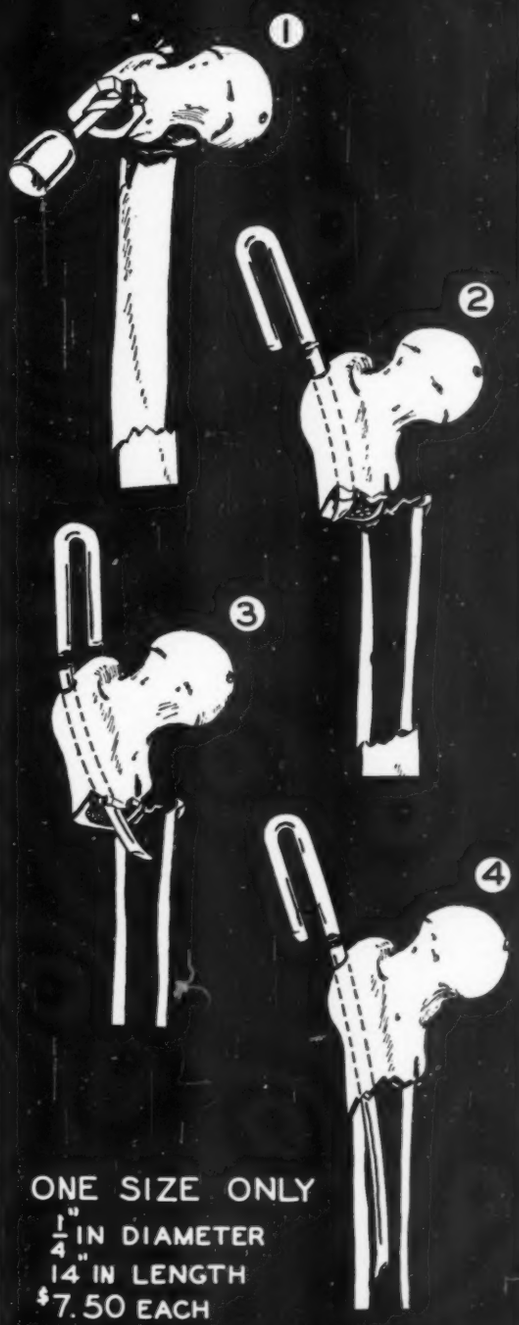

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Editorial

MEDICINE'S OPPORTUNITY OF A LIFETIME

WE are living in one of the most exciting and interesting periods of history. A great deal has happened since the close of World War II and the medical profession, which hoped to share with the people of America a relatively normal and peaceful postwar existence, now finds itself in a period of challenge which I believe offers medicine's opportunity of a lifetime.

During the past few years the threat of World War III has brought many problems of a nature to cause us as a profession to limber our economic and political muscles. We no longer concern ourselves only with the scientific parade but economic and political affairs attract our interest and our skills and we find it effective and stimulating to be doctors and citizens, too.

This is as it should be, for some physicians had neglected not only their community but also their political responsibilities in the period following the end of the last great war, and that was not good for them or for their country. When Oscar Ewing launched his drive for federalized medicine in 1948, he brought to the bar of public opinion an obvious and blatant attack on the democratic system of free enterprise. Ewing misjudged doctors and the public, however, and his very act served to unite our profession as never before and to alert millions of our people to the dangers of socialism.

The national education campaign of the American Medical Association proved most effective. Individual physicians and county and state medical societies accepted the challenge and fought bravely and well, armed only with the facts. The result, hinging in good measure on the 1950 elections, sent the Ewing proposal to ignominious defeat for the time. The 1950 elections brought victory for free enterprise as an aroused citizenry bespoke itself. The activity of the medical profession in political action gave it new prominence in civic affairs and set the stage for what I sincerely believe to be our opportunity of a lifetime. We doctors now have a golden opportunity to continue and broaden our community leadership and to accept our responsibilities in civic and political affairs in 1952, the year of decision.

To make the most of these opportunities we must go on with renewed vigor, supporting over and above our scientific pursuits those principles so dear to Americans. We must lend our support to the many worth while community affairs which advance the welfare of the citizen and which serve to intensify his appreciation of America. It is a cause requiring unselfish devotion, time and energy. It means sacrificing personal pleasure for the common good.

Freedom is our most important heritage. We are in danger of losing it unless we have the will to fight. To remain free we must be responsible men and we must never falter in setting a pattern of democratic action and civic responsibility which all may follow.

People look to the medical profession for much more than medical care. We learned that

in the battle with the Ewing forces, and many physicians, to their complete surprise, became aware of this fact. Let it not be forgotten that thinking Americans know and respect the doctor not only for his professional accomplishments but also for his integrity, his wisdom and his willingness to defend the freedom of our people. Thus we have, in my opinion, the opportunity of a lifetime to lead the thinking of the nation. If we do our part, we may change the course of events at the polls in November, for at the time we shall either start the long road back to the kind of government our forefathers created and which made us the greatest nation in history or we shall further succumb to the inroads of socialism.

However, to grasp the opportunity before us effectively, we must have clean hands. We must do more than talk about ethics and moral standards. Our honored profession so high in the public esteem must discipline its members and do it fairly and effectively if we are to justify our exalted position. Physicians who are guilty of overcharging, neglect of patients or overtreatment must be dealt with. As we continue to provide Americans with the best medical care in the world, we must be certain that we maintain the highest possible professional standards, for those few doctors who violate their oath and good moral principles play into the hands of the bureaucrats by providing disgruntled patients who are willing to chance socialized medicine.

We must also pull together in a great cooperative effort to provide maximum strength. As President of the fine Colorado State Medical Society I was impressed by the devotion of the few who lend their talents to the welfare of organized medicine. However, like others who have served in positions of leadership, I was dismayed because so many doctors fail to take part in medical affairs and yet are among the first to criticize after policy decisions have been made. I therefore hope that more doctors will become better informed about their organizations, will serve them as best they can and will loyally support their policies and objectives.

Tomorrow will be almost too late to begin the long fight, but we can start with the first patient we see and we can keep everlastingly at the task of discharging our obligations as citizens as we face our opportunity of a lifetime in the fight for freedom. It will require patience and diligence, faith in ourselves and faith in God, but we can succeed. A few years ago we entered battle and we won. We are stronger now. Let us finish the job.

ERVIN A. HINDS, M.D.

Original Articles

POSTOPERATIVE TREATMENT OF PERIPHERAL VASCULAR INJURY BY EMPLOYMENT OF CONTINUOUS SPINAL ANESTHESIA PROLONGED FOR ELEVEN DAYS*

F. Paul Ansbro, M.D., John J. Black, M.D. and Francis S. Latteri, M.D.
Brooklyn, New York

SINCE Lemmon introduced continuous spinal anesthesia in 1940–1941,[1] there has been a tremendous rise in interest in subarachnoid block. Its use in surgery has raised this modality of anesthesia to a plane comparable with other methods (except epidural) as regards safety. The therapeutic value of spinal anesthesia has also increased, due mainly to the fact that this method makes fractional injections possible. The role of the sympathetic nervous system in the treatment of peripheral vascular disease is more apparent every day. The ill effects of concomitant vasospasm in vascular occlusive processes are recognized and the value of interrupting the nerve supply to the spastic vessel walls has been established since the work of Gage and Ochsner,[2] and Ochsner and DeBakey.[3] The reasons for interrupting sympathetic impulses are evident when the innervation of the vessels of the extremities is recognized. In reviewing the anatomy and physiology of the autonomic nervous system in the light of present knowledge we recognize that the autonomic system is the source of neural control over the blood vessels of the body. The sympathetic portion of the autonomic (which controls blood vessel caliber almost exclusively) originates in the cord from the level of the first thoracic to the second or third lumbar in the intermediolateral portion of the gray matter. (Fig. 1.)

From here preganglionic fibers leave by way of the anterior roots to the paravertebral sympathetic ganglia through the white rami communicantes. In the sympathetic ganglia these fibers synapse and pass by way of the gray rami back to the somatic nerves and accompany them in their peripheral course whence they send off numerous fibers to the blood vessels of the extremities. (Fig. 2.) A branch arising in the sympathetic ganglion may not join other fibers in the gray ramus but runs directly as a postganglionic fiber to the main vessel of the limb.[4] (Fig. 3.) In the main, the major preganglionic outflow to the lower limbs is from T10 to L3[5] or T10 to L2.[6] (Fig. 1.) It is evident that the lowermost limit of preganglionic outflow must be at L3 because below that level there are no white rami communicantes.[7]

The vasoconstrictor mechanism of the body is complex but it is known that stimulation of the sympathetic nervous outflow to the limbs will cause constriction of the cutaneous vessels of the limb. Richards[4] states that the strongest contraction takes place in the small arteries and arterioles but other vessels also participate. These are postganglionic "adrenergic nerves"[8] which means that they are subject to the neurohormone adrenin or noradrenin released at their endings. "Vasoconstrictor tone" is effected by the persistent release of these substances at the sympathetic nervous endings as the result of electrical discharges passing through the nerves that originated in the higher centers, namely, the cerebral cortex, and then through a series of four neurones: corticohypothalamic, hypothalamic-spinal, preganglionic (cholinergic) and postganglionic (adrenergic) (Fig. 3), although it has been suggested by Leriche that the sympathetic ganglia of the paravertebral chain act autonomously in that they are capable of transmitting reflexes in themselves without reference to central centers. This is said to be particularly true of the stellate ganglion.[9]

* From the Surgical and Anesthesiology Services of St. Catherine's and Adelphi Hospitals, Brooklyn, N. Y.

Vasodilator Nerves. There is evidence to show that these nerves exist and function but they have never been proven anatomically. It has been suggested that they reach the extremities by two routes:

The first is through vasodilator fibers in the afferent limb (posterior root) since Stricker demonstrated that if the distal end of a cut posterior root in the lumbar region of a dog is stimulated it will result in vasodilatation. This is called "antidromic vasodilatation." (Fig. 2.)

The second is through vasodilator fibers within the sympathetic nervous system itself. The phenomenon of "adrenalin reversal" whereby a sympathetic fiber depressed by ergotoxin will, when stimulated, not result in constriction but in dilatation of the vessels supplied by the depressed nerves.[8] Grant,[10] however, postulated that since control of the blood supply to muscle was predominantly chemical any vasodilatation following muscle exercise must be due to the presence of metabolites in the muscles themselves. Other investigators have supplied evidence to support the sympathetic dilator theory as, for example, Lewis and Pickering,[11] who demonstrated that after body heat is raised the temperature of a normally innervated limb would also rise but that of a sympathectomized limb would rise no higher than it was before the rise in general body temperature. The point brought up here was that the normal limb exerted, through its intact sympathetic nervous supply, a vasodilator effect but the sympathec-

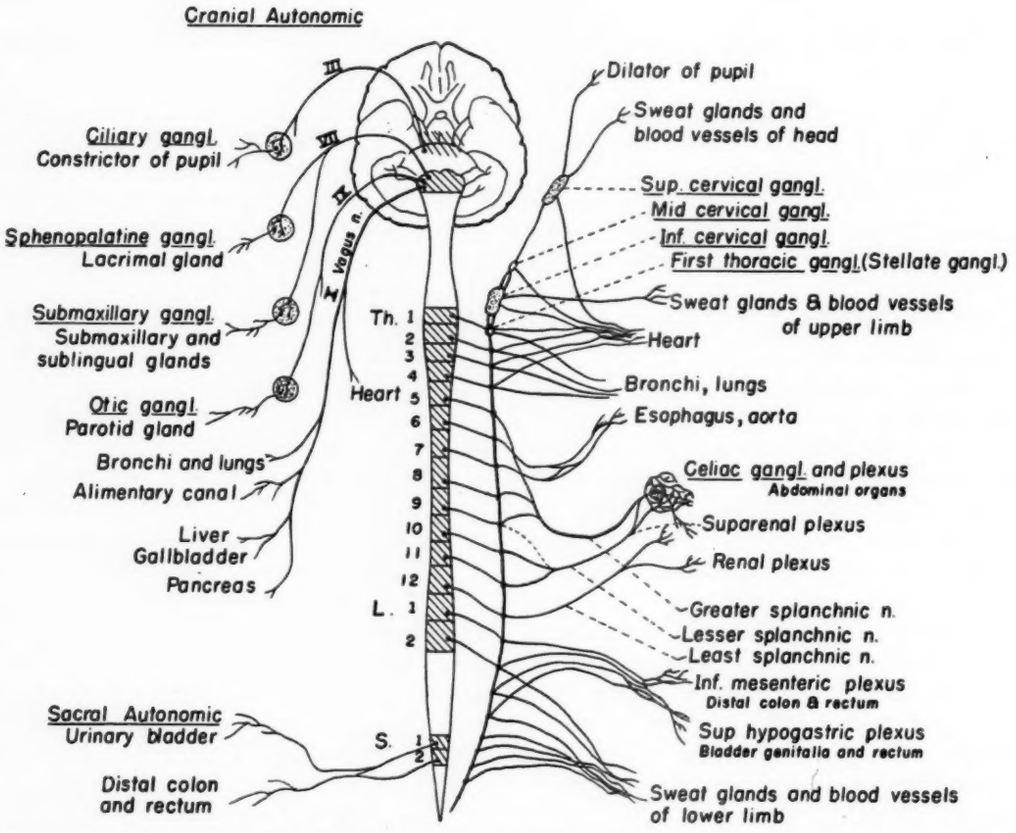

FIG. 1. Scheme of autonomic system. The white rami communicantes extend from T1 to L2 (or L3). The paravertebral ganglia lie on the side of the vertebral column bilaterally and the prevertebral ganglia are intimately connected with the great vessels in front of the vertebral column more distally and are indicated by name (celiac, superior hypogastric, etc.). (Redrawn from Manual of Surgical Anatomy by T. Jones and W. C. Shepard, Philadelphia, 1945. W. B. Saunders Co.)

tomized limb being deprived of these fibers could not produce the effect of flushing the skin as on the unoperated side.

Local Nervous Control of Blood Vessels. As indicated previously, blood vessels to a certain extent are subject to local control of their caliber as well as by the control exerted by pathways leading from the sympathetic nervous system. The latter system exerts control over the larger vessels (the arteries and arterioles). Local control is mainly chemical in nature (chemical vasodilators, for example, histamine, H-substance) and metabolites (produced locally by the tissues themselves) and also chemical vasoconstrictors, for example, adrenalin or nor-adrenalin (carried to the locus by the blood stream). The effect of local temperature is a well known causative agent in producing changes in blood vessel caliber. Heat is a powerful vasodilator (the hyperemia and resulting redness of a heated area of the skin) and cold is a vasoconstrictor (the pallor of a low temperature area). The paleness due to cold may change to red when the paralytic effect on the blood vessels exerts its effect. Usually there is more than enough blood flowing to an extremity to take care of its nutritional needs, even if excessive; hence there may be great restriction of blood flow to a limb before any nutritional changes become evident. Kunkel and Stead[12] have shown that blood flow to the lower extremities may be reduced to one-third of the maximal amount before painful symptoms develop and disturbances of nutrition of the part become apparent. On the other hand, intermittent claudication that prevents walking for even a few yards may be present even though the limb appears normal.

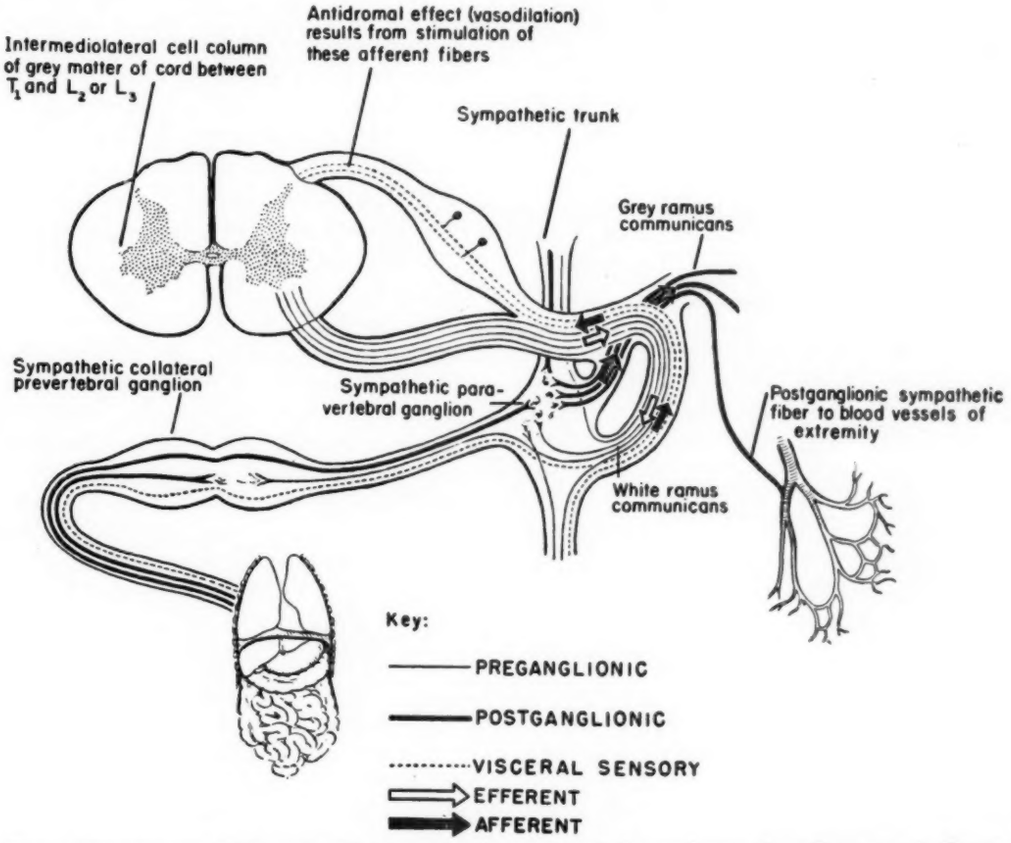

FIG. 2. The intermediolateral cell column in the cord and the pathways for afferent and efferent impulses are indicated. The synapse for "trigger point" reflexes takes place in the autonomic portion of the cord (intermediolateral column of gray matter between T1 and L2 or L3). The presumed antidromal effect may be attained by stimulation anywhere along the posterior route. (Redrawn from Ciba Clinical Symposia, Ciba Pharmaceutical Products, Inc., Summit, N. J.)

Skin Temperature. The gradient of skin temperature is an important indicator of the

efficiency of the blood supply of any part of the body. According to Richards[4] the skin temperature of the lower limbs differed slightly between right and left legs and in thirty cases the average temperatures (room temperature 18–22°C.) were as follows:

Right Leg	Centigrade	Fahrenheit (Approx.)
Groin	33.4	92.
Mid-thigh	30.7	87.2
Knee	28.2	83.
Ankle	27.3	81.
Dorsum of foot	24.5	75.5
Great toe	20.3	69.

It will be observed from these findings that there is a progressive fall in temperature from the groin (33.4°C.) to the toes (20.3°C.). The same type of vasoconstrictor gradient is also true of the upper extremities (from 30.8°C. at the deltoids to 21.0°C. at the fingertips)[4] although it is more difficult to obtain standard temperature readings in the upper extremities usually because of the wide difference in temperature in normal subjects.

The maintenance of vasoconstrictor tone is dependent upon the sympathetic nervous system for more distal areas and on local tissue metabolites for proximal areas of both upper and lower extremities.

Spinal Anesthesia and Its Effect on Vasomotor Supply to Lower Extremity. As stated heretofore, the sympathetic nervous supply to the legs extends from T10 to L2 or L3 (preganglionic fibers from the intermediolateral cell column of gray matter and passing out over the anterior root). It is thus necessary to block these fibers in order to get the vasomotor supply to the legs *in toto*. If the anesthesia extends any higher, the resultant blood pressure fall may seriously interfere with the results. As Richards[4] states, "This method has the advantage that nervous vasoconstrictor impulses are known to be abolished and therefore any failure in response must be due to vascular defect. Thus spinal anesthesia will induce vasodilatation in feet which have failed to respond to reflex vasodilatation."

An occluded or damaged vessel may become the site of reflex vasoconstrictor changes in other vessels of the same extremity. Occlusion or damage by trauma to the popliteal artery may result in deficient circulation below the point of occlusion or damage due not only to the latter causes but also the reflex constriction of the other vessels of the extremity as well as the constriction of the damaged or occluded vessel itself. The damaged vessel serves as a "trigger point" whereby afferent impulses are sent via the posterior root to the spinal cord which transmits them through synapses to the anterior root; this in turn sends efferent vasoconstrictive impulses to the other blood vessels of the extremity. (Fig. 2.) More ischemia of the parts below the popliteal space may be caused by compression of the fine collaterals by a hematoma and result in gangrene.[13]

The controversy concerning the effect of sympathectomy on the flow of blood to the muscle of a limb is still extant. Grant and Pearson[14] in 1938 and Kunkel et al.[12] in 1939 demonstrated that electrical or chemical stimulation (adrenalin) of the sympathetic nervous system caused increased blood flow to the muscles. Naturally blocking the sympathetic nervous system should produce the opposite. Richards is of the opinion that "sympathetic stimulation *constricts* the arteries and arterioles but *dilates* the large muscle capillary bed." Freeman and Montgomery[15] postulated that sympathectomy released the constriction of the arteries and arterioles and thus increased the blood supply to the muscles. Richards believed that the "circulatory reserve" of the extremity is the major factor in getting benefit from sympathectomy. If this reserve is poor, sympathectomy will not help. If it is adequate, sympathectomy will produce a good result, particularly if vasospasm is a major contributing factor.

It has been ascertained that in animals sympathectomy causes permanently increased blood flow through the femoral artery[16–18] and following ligature of a main vessel produces an enlargement of the collateral bed. However, in the human the problem is by no means near a solution; but our case would appear to demonstrate that chemical sympathectomy by continuous spinal anesthesia may furnish some evidence that in injury to the peripheral arterial supply abolishing sympathetic impulses may be of aid in controlling peripheral ischemia in man and that this increased blood flow results not only in hyperemia of the skin

(due to pooling of the blood there) but also in increased blood flow to the muscles of the extremity.

It becomes evident from the foregoing review of the present knowledge of the nervous and humoral control of the peripheral circulation that any deliberate interference with this control would cause changes which are now able to be better understood and treatment rationalized on a sounder basis.

The following case will illustrate the efficacy of removing reflex vasoconstriction in a limb whose main vessel has been damaged.

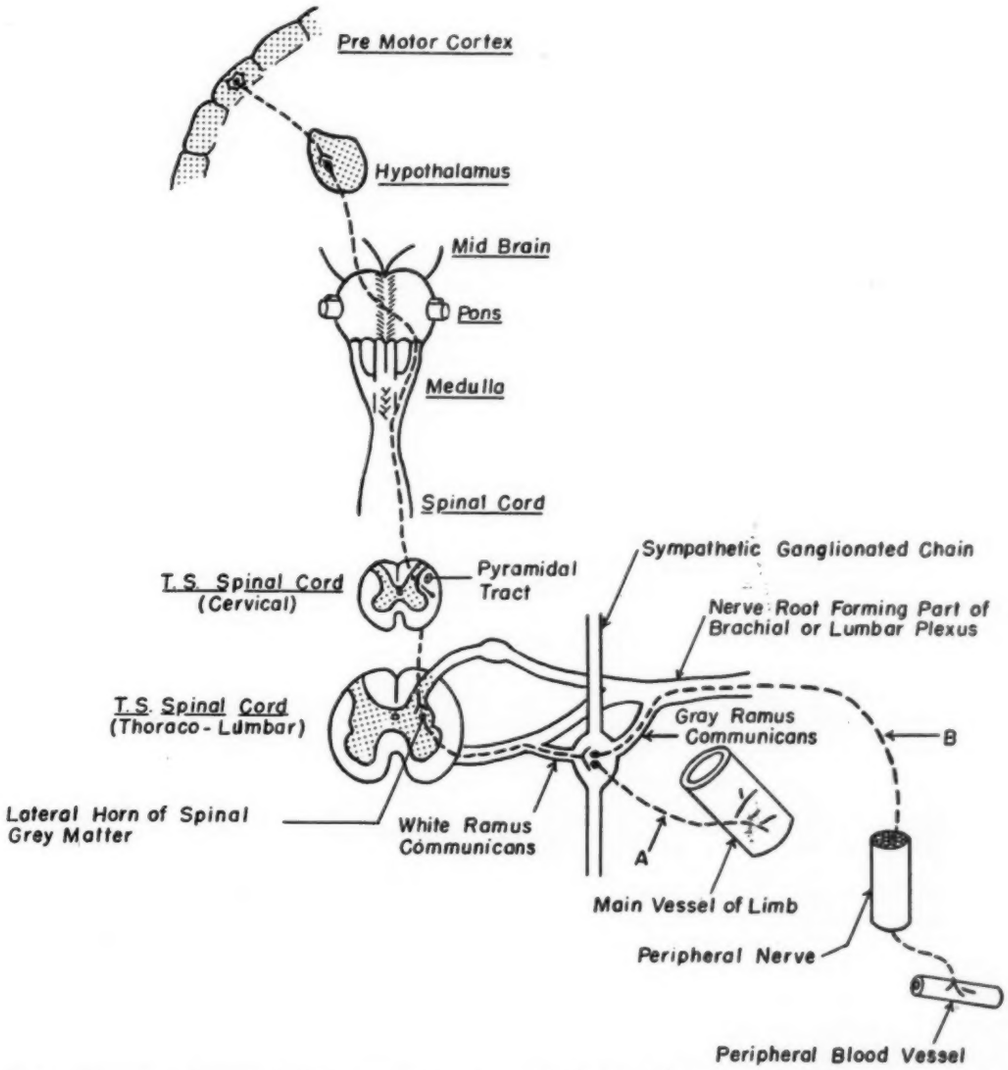

FIG. 3. Diagram of sympathetic vasomotor pathways to limbs. A, branch arising in the sympathetic paravertebral ganglion and running directly to a main vessel of the limb. B, postganglionic sympathetic fiber which traverses the gray ramus communicans and accompanies the somatic nerve to peripheral blood vessel. The fibers in the white ramus communicans are preganglionic (cholinergic); those in the gray ramus postganglionic (adrenergic). The fiber at (A) is depicted as postganglionic although it may also be preganglionic, having its cell of origin in the lateral horn (intermediolateral cell column) of the gray matter of the cord between T1 and L2 or L3 and passing through the paravertebral sympathetic ganglion without synapsing. (Redrawn from The Peripheral Circulation in Health and Disease by R. L. Richards. Baltimore, 1946. Williams and Wilkins Co.)

CASE REPORT

M. T., a forty-nine year old white longshoreman, was struck across the back of the right

knee by a piece of lumber on May 20, 1949. On admission to St. Catherine's Hospital one hour later the bleeding was well controlled and there was no clinical evidence of shock. The past history was essentially negative. The only significant physical finding, with the exception of the present injury was hepatomegaly (the liver extended to the umbilical level). There was evidence of trauma to the popliteal space with damage to the popliteal artery and vein. The artery sustained discontinuity through rupture of the intima and formation of a thrombus about 3 inches in length. Below the popliteal space the leg was cold and no dorsalis pedis or posterior tibial pulsations could be elicited.

The operative procedure, begun three hours after the accident, lasted two hours. The artery and veins were dissected free; the artery was opened and the thrombus removed. Closure of the artery was accomplished over a No. 12 T-tube. Heparin, 2 cc., was injected directly into the artery at this site. Following this procedure there was a slight increase in skin temperature and pulsations were faintly palpable distal to the anastomosis. The wound was cleaned and sterile saline dressings were applied. Eleven days postoperatively the T-tube was removed and two days later a secondary closure was accomplished.

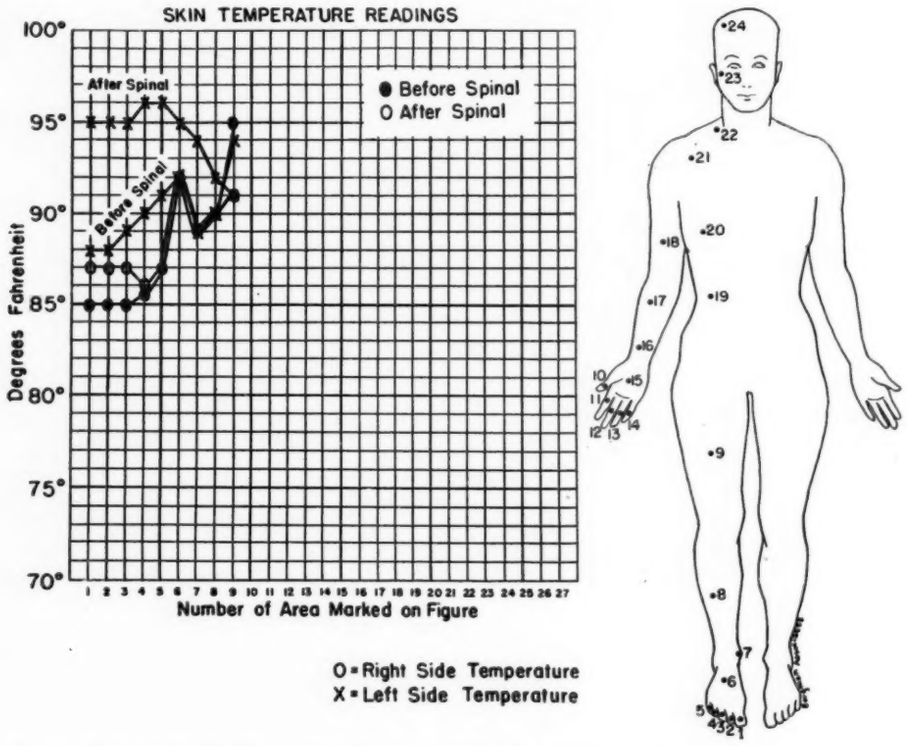

FIG. 4. Patient M. T. Thermocouple readings taken nine days after the onset of the continuous spinal anesthesia indicating the rise in skin temperature from 58°F. in the injured leg to 85°F. before spinal and 87°F. after spinal. By "before spinal" is meant that the spinal anesthesia is allowed to wear off for several hours and readings then taken. By "after spinal" is meant that an injection is made through the catheter and the time allowed for a full spinal anesthesia to take place (paralysis of the limbs, etc.).

Preoperatively the patient received demerol, 100 mg., and atropine, $\frac{1}{100}$ gr. Spinal hemianesthesia (nupercaine, 5 mg.) was chosen. Throughout the operation the blood pressure was maintained at 140/80 and the pulse at 92.

Postoperatively the patient received antibiotics, oxygen therapy, papaverine and heparin (dosage being controlled by clotting time). A right lumbar paravertebral sympathetic block was performed on the first, and again on the second, postoperative day. The foot became slightly warmer (thermocouple reading on great toe 15°C. or 58°F.) but no oscillometric reading could be obtained in this leg.

Because of the uncertainty regarding the viability of the leg below the popliteal artery repair and having in mind the very high incidence of gangrene following injuries of this type,[13] it was considered advisable to relieve any vestige of vasospasm by continuous spinal anesthesia as suggested by Smith and Rees[19] for the treatment of peripheral emboli. A Tuohy catheter was inserted into the subarachnoid space at the level of L2 and L3 and advanced 5 cm. It was secured in place by adhesive straps and sterile gauze. The following solution was prepared.* 20 mg. (2 cc.) light nupercain, 3 cc. 10 per cent glucose, 150 mg. (3 cc.) ephedrine, 500 mg. novocain crystals and aqua dest., q. s. 10 cc. The ephedrine was added to effect prolongation of the spinal anesthesia although the later work of Helrich and associates[20] has demonstrated that ephedrine has little value in this regard.

At varying intervals but usually about four to five hours apart 2 cc. of this solution were injected through the catheter and the usual analgesia and paralysis of subarachnoid block ensued. Over a period of eleven days seventy-two injections were given through the catheter. The patient was permitted to come out of the influence of the anesthesia for one to two hours each day to aid in bladder and bowel evacuation. No catheterization was necessary. Anesthesia ascended no higher than D9 to D10 dermatomes. The patient's blood pressure was carefully watched and there was never any need for support of the circulation by vasopressors or intravenous fluids. Anesthesia was established on May 23, 1949, at which time the temperature of the great toe was 58°F. and a slow, gradual rise in skin temperature of the right foot began. This rise, however, was not appreciable until seven days later although clinically the appearance of the foot improved turning from cyanosis to a more healthy color. On June 1st thermocouple reading showed an elevation of temperature in the great toe to 85°F. (Fig. 4) and two days later to 91°F. (Fig. 5.) This indicates that the collaterals had now finally overcome their reflex spasm and the popliteal artery itself had established almost full continuity so that the temperature differential between the two legs was only 4 to 5 degrees. Unfortunately, we did not record the

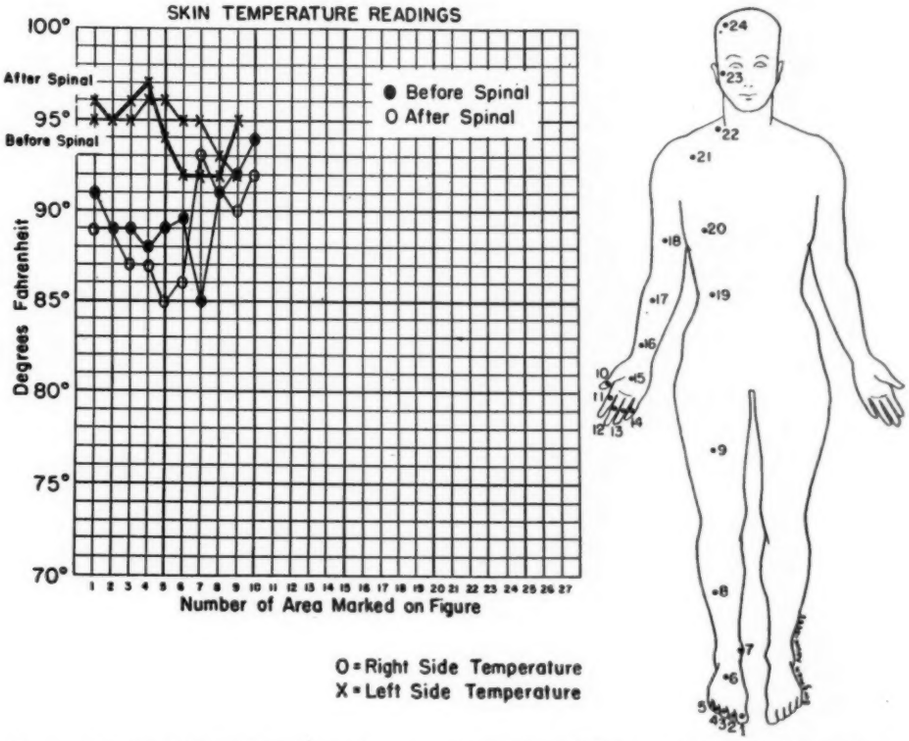

FIG. 5. Patient M. T. Readings taken two days later, following which spinal anesthesia was discontinued. The fall of 2°F. in skin temperature in the affected foot following spinal may be explained as due to the cutting off of vasodilator impulses to the right leg.

* Suggested by Barnett A. Greene, M.D.

temperature of the left foot before the beginning of the spinal anesthesia but all agreed that it appeared in the neighborhood of normal (70°F.).

The spinal anesthesia was discontinued on June 3rd, having been established for eleven days. Nothing untoward occurred during the procedure with reference to the spinal anesthesia. The patient had no headache at any time either during or after the anesthesia. Spinal fluid examinations showed but little change aside from a slight increase in cell count. Ten days after the discontinuance of the spinal anesthesia the temperature of the injured right leg and foot was only 1 degree lower than the opposite. However, it cooled more readily when exposed to air. There was no evidence of sensory impairment in either leg. Both responded well to pinprick and there was no evidence of motor impairment in either one.

The wound healed well and the patient was discharged from the hospital on July 13th, walking on crutches. He was seen again on September 15th with a number of subjective complaints such as "growing pains" in the leg with stiffness in the morning. On examination there was some evidence of edema of the right leg, which was about 1.5 cm. larger than the left, and some evidence of hyperalgesia and paresthesia on the inner surface of the ankle. The knee and ankle jerks were present bilaterally. The patient had full motor power in the extremity but continued to use crutches "to take weight off it."

SUMMARY

The present day evidence of innervation of the vascular tree of the lower extremity and the adverse effects of vasospasm accompanying vascular injury is presented. A method of overcoming vasospasm by continuous spinal anesthesia is suggested. More recently we have adopted continuous epidural block as a safer and more controllable method for attaining this end. No deleterious effects from spinal anesthesia prolonged for eleven days were observed in this patient.

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COMPLICATIONS FOLLOWING TRANSTRACHEAL ANESTHESIA*

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TRANSCRICOID instillation of cocaine for topical anesthesia of the larynx was first suggested by Georges Caynut[1] in 1920. Little has been heard of this method of topical anesthesia in this country until 1948 when Harkins and Salzberg[2] hailed it as being most suitable for endoscopic procedures of the trachea and bronchi. Bonica[3] likewise has extolled the value of this method of anesthesia for facilitating insertion of endotracheal catheters. The method is now used extensively in some localities by anesthesiologists for intratracheal intubation.

We were reluctant to adopt the method for two reasons. (1) The needle must be introduced through the skin and tissues of the neck into the trachea. When it is withdrawn, it is no longer clean in a surgical sense and the possibility of contamination of healthy tissue exists. Many patients in whom endoscopic studies or endotracheal intubations are indicated have suppurative diseases of the lung, and the trachea is not free of virulent bacteria. (2) A needle of a small bore must be used. Regardless of precautions exercised, many patients are uncooperative and cough or make attempts to swallow when the drug is instilled. Breakage of the needle appeared to us to be a likely complication. After noting the seemingly good results and the enthusiasm of our colleagues we cast aside the objections and adopted the method in a limited way. During the past two years we have attempted approximately 350 instillations, using either 2 cc. of 4 per cent cocaine or 2 cc. of 2 per cent pontocaine to obtain topical anesthesia for endotracheal intubation. On the whole the results have been most gratifying but in two instances we encountered each of the complications we had feared. Case 1 is a report of diffuse deep cellulitis of the neck, which almost terminated fatally.

CASE REPORTS

CASE 1. A forty-seven year old colored man was brought to surgery for the lysis of buccal mucosal adhesions, which had formed following the removal of a molar tooth fifteen years previously. The patient was unable to open his mouth more than 1 cm. Evidence of oral sepsis was present, presumably due to the poor oral hygiene. The anesthesiologist thought it was advisable to insert a nasotracheal tube under topical anesthesia before inducing general anesthesia, and decided to utilize the transcricoid technic. Two cubic centimeters of 4 per cent cocaine were injected through the cricothyroid membrane without difficulty. Difficulty was experienced in passing the nasotracheal tube into the trachea and the operation was cancelled. After returning to the ward the patient complained of a sore throat. Saline gargles were ordered.

On the second day the patient complained of pain and difficulty in swallowing. Diffuse cellulitis was developing in the upper two-thirds of the neck in the region of the thyroid cartilage. Chemotherapy and antibiotics were started. By the third day the diffuse swelling had extended to the base of the neck. The suprasternal notch was obliterated by the swelling and there was marked soreness in the throat and neck. Also, there was some difficulty in breathing but decision to do a tracheotomy was deferred because of the infection. The patient's temperature during the second and third day ranged between 102° and 103°F. The patient's general condition improved and on the fourth day the soft tissue swelling began to subside. The temperature fell to 100.4°F.

The patient continued to improve and on the sixth day was able to take fluids by mouth. He was not free of fever, however, although at times the temperature during the day was normal. A residual indurated mass was present in the region of the thyroid gland, which was much more marked on the left side of the neck than the right. X-rays at this time revealed soft tissue swelling of the lower neck with marked displacement of the trachea to the right. A collection of air or gas was also present

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in this region. The presence of gas was interpreted as being the result of gas-forming organisms. No purulent discharge or localization of infection occurred, so cultures were not obtained. By the thirteenth day the indurated mass had almost disappeared. The position of the trachea appeared to be restored to normal but x-rays revealed that it still was displaced somewhat to the right. The gas noted on previous films was almost completely gone.

CASE II. A transcricoid injection was attemped on a seemingly cooperative subject, using a 1 inch 25 guage needle. Members of the staff are cautioned not to introduce the needle to the hub, and fortunately this warning was heeded in this instance. As soon as the cocaine solution was instilled, the patient became excited and began to cough and swallow, and move the larynx up and down in spite of attempts at fixation by the operator. The needle was felt to snap after the second or third movement of the larynx. Fortunately, the shaft was protruding approximately 1 mm. above the skin surface and was easily grasped and withdrawn with a hemostat.

COMMENT

Transcricoid instillation of local anesthetics for inducing topical anesthesia undoubtedly deserves a place in medical practice. The technic is not as innocuous as has been supposed and can be followed by serious complications. Harkins et al. encountered three cases of superficial cellulitis in their series of over 1,000 instillations, two of which required incision and drainage. It may be that the antibiotics, which are used almost routinely after operation, have accounted for the absence of infection in our cases and in the hands of others. The majority of subjects in whom we have employed the technic received antibiotics postoperatively; the patient in whom cellulitis developed did not.

SUMMARY

Two possible complications of transcricoid instillation of local anesthetics into the trachea are cellulitis of the neck and breakage of the needle. Both of these occurred in a series of approximately 350 instillations. The procedure is not as innocuous as has been supposed and may be followed by undesirable sequelae.

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EFFECT OF ANESTHESIA ON THE EOSINOPENIC RESPONSE TO SURGICAL TRAUMA*

A PRELIMINARY REPORT

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THE role of surgical trauma on the pituitary-adrenal system has been investigated recently and it has been established that there is a marked diminution of the circulating eosinophils following major surgical intervention.[1-3] This would indicate stimulation of the pituitary-adrenal system as a response to surgical trauma. The effect on anesthesia in this regard has received little attention. Theoretically, since most anesthetic agents can be toxic, it is possible to conceive that they, *per se*, might give an alarm reaction. On the other hand, since narcosis seems to interfere with intracellular metabolism, it might be possible that anesthesia would modify the pituitary-adrenal cortex response to operative trauma and to stress, in general. It was deemed desirable, therefore, to study the effect of anesthesia on the adrenal response to stress imposed by surgical intervention.

METHOD

The inference of changes in the number of circulating eosinophils was the method employed to measure the adrenal cortical response.[4,5] Forty-two patients undergoing surgical intervention during general anesthesia were tested by means of successive eosinophil counts. Three eosinophil counts were made on each patient from blood obtained by venipuncture. The first count was determined before anesthesia; the second count was made two hours after the start of operation, and the third count was made five hours after the start of the operation. Preanesthetic medication consisted of morphine or demerol combined with scopolamine or atropine in doses to produce adequate psychic sedation without respiratory depression. In addition, 500 mg. of procaine amide hydrochloride was administered in capsule form.[6] All these premedicant drugs were administered about one hour before induction of anesthesia. Epinephrine, ephedrine or other vasopressors was not administered in any case because of the possibility that these drugs might alter the eosinopenic response.[7] In eight patients eosinophil counts were determined before the administration of preanesthetic medication and repeated one hour after such administra-

TABLE 1
GROUP I: DURATION OF ANESTHESIA LESS THAN TWO HOURS

Case	Age	Sex	Surgical Procedure	Circulating Eosinophil Count per cu. mm.		
				Before Anesthesia	Two Hours after Start of Surgery	Five Hours after Start of Surgery
1	10	M	Muscle transplants right foot	192	31	0
2	12	M	Epiphysiodesis	260	100	77
3	36	F	Femoral hernioplasty	86	42	17
4	57	M	Excision of lipoma	170	75	60
5	11	M	Second stage Thorek	286	92	97
6	42	F	Cholecystectomy	94	41	42
7	58	F	Excision of lipoma	159	52	27
8	63	M	Inguinal hernioplasty	51	27	17
9	9	F	Biopsy of synovia, left ankle	167	70	28
10	68	F	Saphenous ligation	86	10	0
11	71	M	Inguinal hernioplasty	107	49	31
12	18	F	Knee fusion	29	9	6
13	83	M	Inguinal hernioplasty bilateral	139	22	16
14	21	M	Hydrocelectomy	696	385	215
15	83	M	Open hip	315	117	82
16	41	F	Keller procedure, bilateral	96	54	32
17	10	F	Nailing of hip	138	38	10
18	57	M	Inguinal hernioplasty	155	73	40
19	14	F	Arthrotomy of elbow	1400	978	600
20	13	M	Section of sternocleidomastoid	335	219	28
21	68	M	Hydrocelectomy	208	146	28
22	9	M	Inguinal hernioplasty	355	219	28
23	30	F	Excision of xanthoma	413	300	50
24	61	F	Reduction of Colles' fracture	104	27	12
25	21	M	Ruiz procedure	128	168	150
26	12	F	Excision of ingrown nail	235	246	257
27	19	F	Removal of hip nail	50	61	63
28	47	F	Excision of tendon sheath	165	140	166

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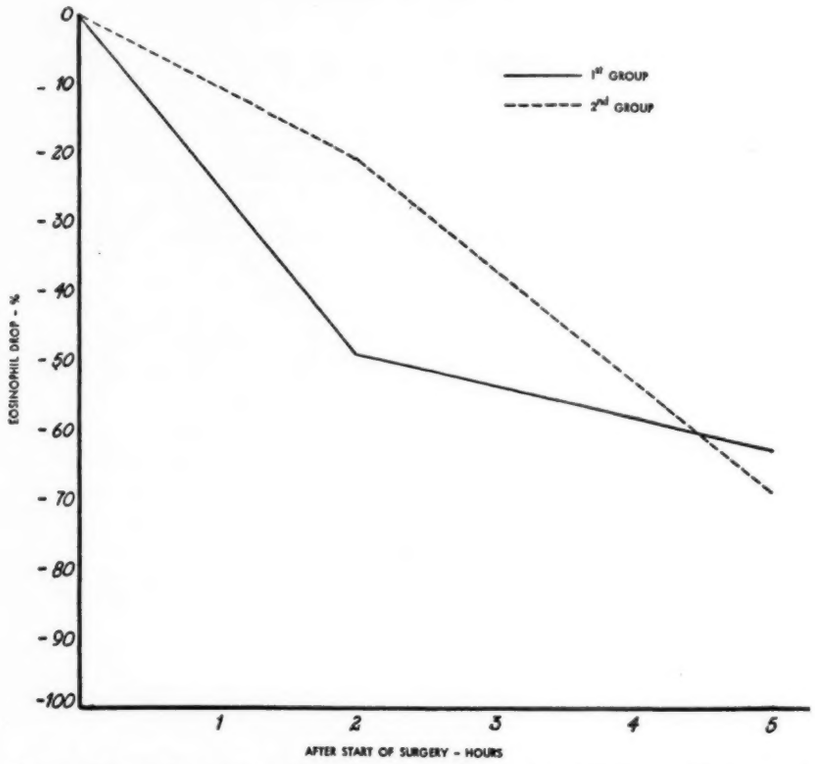

FIG. 1. Composite graphs of modification in the eosinophil counts. First group, duration of anesthesia less than two hours; second group, duration of anesthesia two to four hours.

tion. There was no significant change in any of the patients. In thirty-seven of the patients anesthesia consisted of evipal sodium intravenously for induction complemented by the inhalation of cyclopropane in a closed carbon dioxide absorbing technic. In four patients evipal sodium and cyclopropane were supplemented by ether anesthesia. One patient was anesthetized with nitrous oxide and ether. All operative procedures lasted less than four hours. The patients were divided in two groups depending upon the duration of the operative procedure. The first group of twenty-eight cases comprised those patients whose surgical procedures required less than two hours of anesthesia. The second group included the patients whose surgical anesthesia lasted two to four hours.

RESULTS

The levels of circulating eosinophils before and after the start of surgery are given in the Tables I and II.

The modifications in the eosinophil counts were quite consistent in each of the two groups. A composite graph of each group is represented in Figure 1.

COMMENTS AND CONCLUSION

From an analysis of Table I it is seen that the patients in the first group who were

TABLE II

GROUP II: DURATION OF ANESTHESIA TWO TO FOUR HOURS

Case	Age	Sex	Surgical Procedure	Circulating Eosinophil Count per cu. mm.		
				Before Anesthesia	Two Hours after Start of Surgery	Five Hours after Start of Surgery
1	13	M	Subtotal resection of sternum	280	265	102
2	14	F	Muscle transplant	500	480	123
3	8	M	Yount fasciotomy	285	262	123
4	41	M	Hip fusion	105	80	0
5	84	F	Hip nailing	129	113	7
6	16	F	Synovectomy	93	85	46
7	12	F	Triple arthrodesis	257	200	18
8	70	M	Inguinal hernioplasty	125	86	9
9	46	F	Hysterectomy	91	80	32
10	44	M	Triple arthrodesis	94	72	40
11	12	F	Triple arthrodesis	42	59	5
12	75	M	Resection of descending colon	249	298	260
13	21	M	Subtotal resection of sternum	94	42	19
14	53	F	Bone graft humerus	37	14	6

anesthetized for less than two hours showed, with few exceptions, a diminution of eosinophils of 50 per cent or more two hours after the start of surgery. The last four patients in this group showed no stress, probably because the surgical procedures were trivial (removal of ingrown toe nail, excision of tendon sheath, removal of Smith-Petersen nail, excision of distal toe digit). Twelve of the fourteen patients in the second group who underwent surgical procedures of two to four hours showed a drop of less than 50 per cent of the eosinophils (average, 21 per cent) two hours after the surgery was started. (Table II.) This would indicate that prolonged general anesthesia tends to inhibit a normal response of the adrenal cortex to the stress of surgery. This blocking action of general anesthesia is lost as soon as anesthesia wears off.

Further work is in progress to determine the cause for the delay of the eosinopenic response due to surgical trauma by general anesthesia. The effects of spinal and local analgesia on the response due to surgical trauma will be studied also.

General anesthesia in human subjects delays the diminution of circulating eosinophils following surgical trauma.

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FRACTURES OF THE FEMORAL SHAFT*

A CLINICAL COMPARISON OF TREATMENT BY TRACTION SUSPENSION AND INTRAMEDULLARY NAILING

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FRACTURES of the femoral shaft have always been attended by peculiar problems associated with long periods of immobilization, resultant functional disability and economic hardship. For many years the principle of continuous traction in some type of suspension apparatus until clinical union occurred has been utilized as the safest and the most successful method of treatment. This type of management has continued through the centuries from the time of Guy du Chauliac with innumerable modifications and refinements but always utilizing the essential basic principle. In spite of the obvious disadvantages of the treatment due to prolonged recumbency with its unavoidable sequelae of joint stiffness, muscle atrophy and general debility it is extensively practiced and generally accepted. Many recent observers believe that it is still the method of choice. McKeever, in a survey of forty-seven patients with femoral shaft fractures, found that other methods of treatment presented no advantages over traction suspension concerning the time of immobilization, rate of bone union, incidence of complications or degree of residual disability.

During the past half century there has been an attempt to reduce the period of recumbency in femoral fractures. Methods of internal and external skeletal fixation have been utilized in order to hasten bone union, permit earlier ambulation and reduce residual joint stiffness. These newer methods have been enthusiastically acclaimed by their advocates and at the same time vigorously condemned by those who believe that the risk of complications incident to these methods overcomes any advantages that they might possess. Most recent of these newer methods in popularity, if not in time, is that of intramedullary nailing. Although the origin of this method goes back at least to the work of Lambotte in the latter portion of the nineteenth century, it was revived by Hey Groves in 1918 and its use was described by the Rush brothers in 1939. The procedure attracted widespread interest following the reported experiences of Küntscher of Kiel in 1940. The method was promptly put to trial by Scandinavian, Dutch and German surgeons and has received widespread acclaim in Europe. Following its use in World War II it was skeptically utilized in selected cases in this country but the favorable impressions reported by the original American observers have led gradually to acceptance and even to mild enthusiasm.

The authors have had the opportunity to use open intramedullary fixation of femoral shaft fractures in patients in an Army general hospital. Their impressions of the method as compared with the previous results with traction suspension were so startling that it seemed advisable to make a careful study of the clinical results of the two methods. It appeared to the authors that any new method of treatment of femoral fractures, especially a method requiring open reduction and internal fixation, should be most carefully scrutinized to be certain that the apparent tremendous advantages were not overcome by certain hazards and complications, especially when utilized widely and by the uninitiated. In making a comparative study sufficient time for adequate follow-up evaluation was necessary and only those femoral fractures which were suitable for open intramedullary nailing could be considered in both groups. Patients with complicating bone, nerve or other associated injuries which could affect the results of the individual method of treatment were excluded from the study. Twenty case records remained of patients treated by the traction suspension method. Many of these were first treated in outlying institutions and were transferred to this hospital at varying periods following injury. It is possible that this may have influenced to some extent the results obtained. Compared with this group of patients

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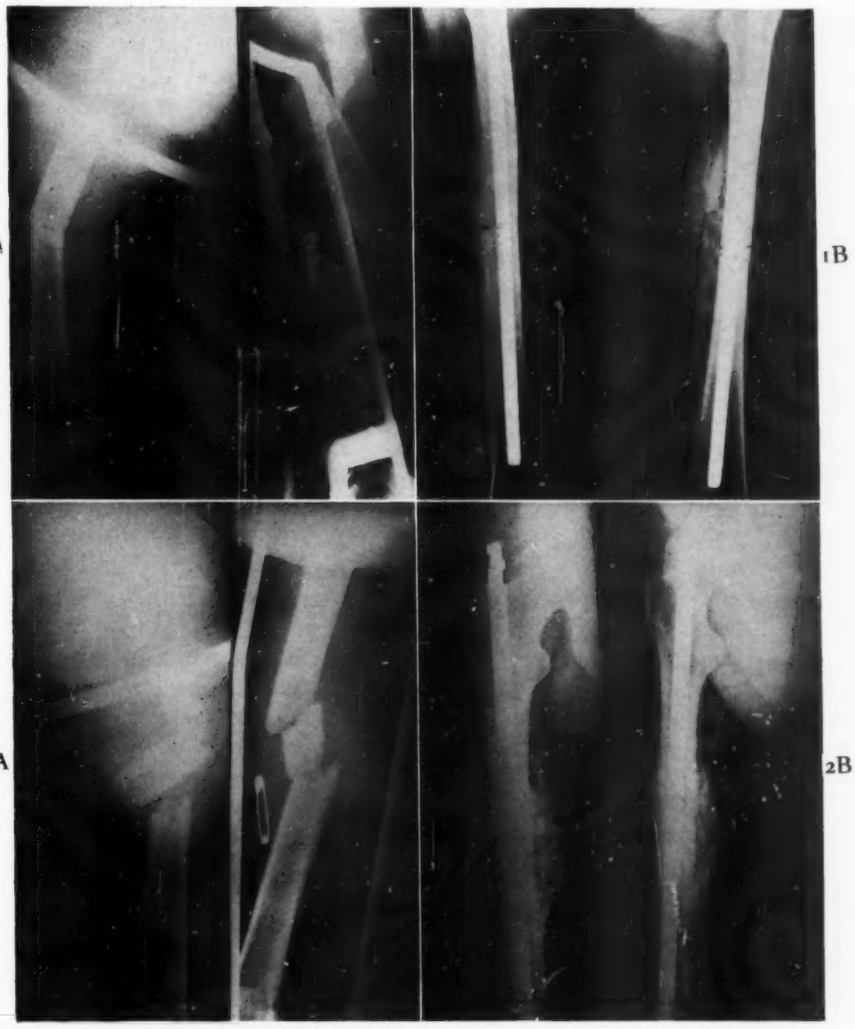


FIG. 1. A, anteroposterior and lateral roentgenograms of an ideal femoral fracture for intramedullary nailing; B, roentgenograms one month after insertion of nail and iliac bone grafts.

FIG. 2. A, anteroposterior and lateral roentgenograms of a segmental femoral fracture which is suitable for intramedullary nailing; B, roentgenograms three months after insertion of nail and iliac bone grafts.

we have studied the clinical results of the first twenty patients treated with open intramedullary nailing. These have been followed up for a minimal period of a year after surgery and the authors took an active part in the operative procedures and subsequent management. There was one patient in each group with bilateral fractures so that the study comprises forty-two fractures of the femoral shaft.

INTRAMEDULLARY NAILING PROCEDURE

It should be noted that open fractures are not included in this method of treatment. In the operative group there were three patients who originally sustained open fractures. These wounds were treated with early débridement and primary skin closure. Operation on the bone was deferred until the wounds were completely healed. The same principle should apply where delayed closure is required or healing occurs by either secondary intention or by skin grafting. Intramedullary nailing is not to be considered in the primary treatment of open fractures. Its modified use in certain gunshot fractures with infection and loss of bone is a separate consideration. These cases are an entity in themselves and are described and evaluated by the authors elsewhere.

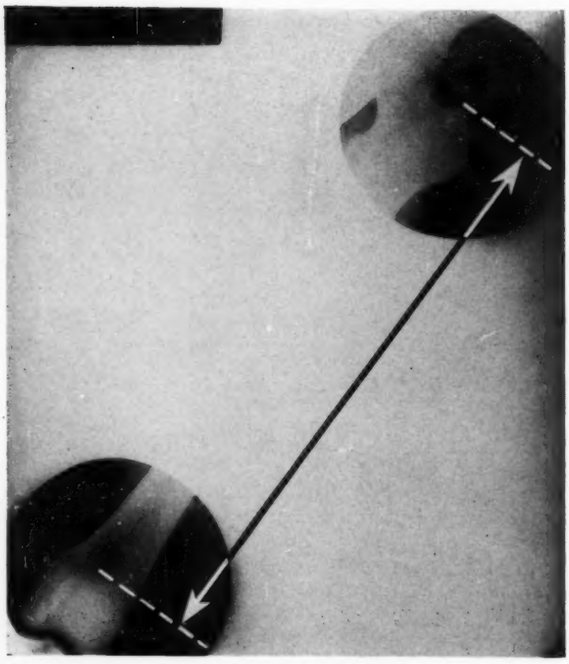


FIG. 3. Scanogram of femoral shaft fracture to determine proper length of intramedullary nail. The exact measurement is the distance between the upper cone point of the tip of the greater trochanter and the lower cone point of the upper patellar margin. An addition of 1.5 cm. is made for protrusion of the nail to facilitate extraction.

Choice of Patients. In general, open intramedullary nailing has been confined to closed fractures involving the middle three-fifths of the femoral shaft. Subtrochanteric and condylar fractures are not appropriate for this type of treatment in our experience although two of our cases were in the upper third of the shaft and close to the subtrochanteric level. Transverse or oblique fractures through the middle of the shaft are ideal for intramedullary nailing. (Fig. 1.) Segmental fractures offer one of the most urgent indications for intramedullary nailing since they are difficult to immobilize by other methods of internal fixation and usually offer a problem of abnormal bone healing with any form of treatment. (Fig. 2.) Although the patients in our group were almost entirely young healthy males, the age of the adult patient is no contraindication to the method. Whereas it is known that elderly individuals do not respond satisfactorily to prolonged traction suspension, the nailing procedure is usually well tolerated. The operation is ordinarily not time consuming and is not attended by shock or significant hemorrhage. Blood transfusion is used routinely at the time of surgery. In our one bilateral fracture in this group both bones were fixed by intramedullary nails in less than two hours and with no suggestion of any ill effects. However, this type of extensive procedure is not recommended and we believe it is safer to perform such operations on separate occasions. We have always used iliac bone grafts in association with intramedullary nail fixation. This procedure has undoubtedly had some influence on the very satisfactory rate and quality of bone healing in the operative group.

Preoperative Management. Upon admission to the hospital the patients are placed in traction suspension, usually with skin traction of 10 pounds. Occasionally skeletal traction through the tibial tubercle is used but this may interfere with adequate skin preparation and is to be avoided if possible. General supportive treatment is instituted and as soon as possible, usually within a week in closed fractures, operation is performed. We have used twenty-four-hour preoperative skin preparation extending from the toes to well above the iliac crest. Following this preparation traction is maintained to the extremity by means of a laced canvas boot and legging applied over the sterile towels.

Estimation of Nail Size. Our experience has been entirely with the clover leaf type of intramedullary nail. The length of nail is determined by scanograms which are made in most cases on the uninjured femur. The portable x-ray machine is used and the large 14 by 17 inch cassette is applied diagonally on the posterior surface of the thigh. The tip of the greater trochanter and the upper margin of the patella are marked on the skin surface and the technician then makes two coned anteroposterior exposures on the same film, moving the tube but not the cassette. The first exposure is centered over the tip of the trochanter and the second is centered over the upper patellar margin. Upon completion of the film measurement of the distance between the tip of the trochanter in the upper exposed portion of the film and the upper patellar margin in the lower exposed portion will give an accurate measurement of the actual distance between these points. Distortion due to ray divergence and tube to film distance is eliminated. (Fig. 3.) The distance is measured in centimeters and 1.5 cm. are added to permit the nail to extend beyond the trochanter in order to facilitate removal. In certain cases in which there has been a previous difference in femoral length or in which pro-

longed overriding of the fragments or marked fragmentation suggest the necessity for some residual shortening, scanograms must be made of the fractured femur rather than the opposite one in order to calculate the required nail length. It is always wise to have two or three additional nails of slightly different length at the time of operation in case the check film taken during surgery suggests a requirement other than that which was calculated.

Nail diameter is somewhat more difficult to determine. On the anteroposterior view of the fractured femur focused over the junction of the middle and upper thirds of the shaft the diameter of the isthmus of the intramedullary canal is measured. The nail diameter is calculated as 1 mm. less than the measured diameter of the isthmus. Actually this measurement is only an estimate and the exact diameter is not determined until the time of operation. In elderly individuals and in certain patients who have been immobilized for some time prior to surgery the diameter is considerably greater than ordinarily encountered. It is essential to have nails of several diameters available at the time of operation when the actual measurement is determined. Ordinary nail measurements vary between 7 and 12 mm. Since the largest nail diameter which can be obtained commercially at this time is 12 mm., a considerable problem arises when the intramedullary diameter is larger. It occurred to one of us (V. H. J.) that it might be possible to overcome this difficulty by nesting two ordinary nails thus producing a combined diameter of 14 to 16 mm. This procedure has been used on numerous occasions and has given very satisfactory fixation.

Operative Approach. All patients are given 200,000 units of penicillin when called to the operating room and this dosage is maintained at twelve-hour intervals postoperatively until the patient's temperature becomes stabilized. The patient is placed on his sound side on the ordinary operating table, traction being made constantly on the fractured extremity. The extremity is prepared from mid-leg to well above the iliac crest. In this side position the thigh presents itself conveniently for a posterolateral longitudinal approach to the fracture site. Another advantage of this position is that the thigh is easily adducted and the trochanter exposed for the insertion of the nail.

The fracture site is exposed with as little periosteal stripping as is necessary to reduce the fracture. Any fragments which have periosteum attached are carefully preserved. In segmental fractures with cylindrical or butterfly middle fragments it is especially important to maintain periosteal connection with the intervening segments to avoid aseptic necrosis and delayed or non-union. Opposing surfaces of the fragments are denuded of scar and granulation tissue. The bone ends are curetted and the medullary canal is opened in both directions. A preliminary reduction is accomplished by traction and manipulation to determine the proper areas of contact in order to avoid rotation at the fracture site. Completely separated fragments devoid of periosteum may be removed unless they will result in undue shortening. If a large middle fragment is free, it should be retained in the hope that eventual revascularization will occur.

The diameter of the intramedullary canal is next determined by inserting the nail of estimated diameter into the canals in the individual bone fragments. The isthmus of the bone must be traversed during this procedure and it is to be remembered that a *snug fit* of the nail is essential for proper immobilization, especially the avoidance of rotation at the fracture site. If the fit is too tight, there may be extreme difficulty in inserting the nail. If it is too loose, there will be inadequate immobilization. We have used intramedullary reamers to assure against obstruction. If a nail of 11 mm. is thought to be the proper size at the fracture site, a 10 mm. reamer is used through the isthmus to make sure there will be no difficulty in nail insertion. Our largest reamer is 12 mm. and this is used whenever a dual nail procedure is required. In such cases the dual nested nails are manually inserted from the fracture site well into the upper and lower fragments to make certain that there is no constriction. Varying combinations of nail diameters may be tried until the proper fit is obtained.

The affected thigh is then flexed and adducted and the long intramedullary guide is inserted into the upper fragment by means of a large hand drill. The guide emerges through the greater trochanter and pierces the skin above it. A small skin incision is made at the point of emergence of the guide. A hollow drill 10 mm. in diameter is then fitted over the point of the guide and an opening is made through the cortex of the greater trochanter. The drill is re-

moved and is replaced over the point of the guide by a nail of previously calculated length and of the diameter determined by insertion into the canal at the fracture site. The nail is driven in lightly with a mallet. As soon as the nail has progressed well into the canal, the intramedullary guide is removed from the fracture site and the nail is driven in without it.

A word of caution is advisable at this time concerning the driving home of the intramedullary nail. A certain amount of resistance is necessary if a snug fit is to be obtained and adequate immobilization achieved. However, if the gradual progress of the nail by light mallet taps fails to continue, violent pounding with the mallet will only produce further cortical impingement and withdrawal will become more difficult. It is also readily apparent to the operator after a few experiences that the sound and feel of the impinging nail end in the cortical bone will come as a forewarning against further impaction. If impingement occurs, the nail must be immediately extracted. Correction may be achieved by slightly rotating the nail in the canal, by using a nail of smaller diameter or by further reaming of the canal from the fracture site. Ordinarily the insertion will be easily accomplished with a minimal amount of force.

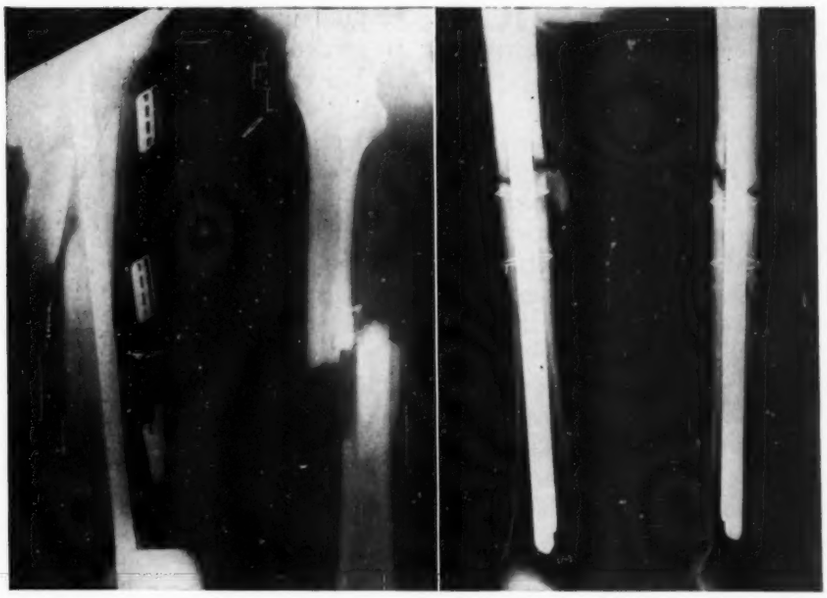
When the nail emerges at the lower end of the upper fragment, it is permitted to protrude for about 1 cm. The lower fragment, or the segmental fragment as the case may be, is now manipulated so that its medullary canal is fitted over the projecting nail end. Great care must be exercised at this point to avoid rotation of the fragments. The two fragments are now firmly grasped with bone-holding forceps and are placed in firm contact while the nail is driven through the remaining portion of the medullary canal. Upward pressure on the foot and leg will assist in preserving bone contact. It is at this point in the operation that distraction of the fragments by the mallet blows must be avoided. If it occurs, a series of blows by the operator's hand against the patient's heel will ordinarily overcome the distraction and produce impaction of the fragments. If this procedure is unsuccessful, roentgenograms should be taken immediately to determine whether there is impingement of the end of the nail in the cortex of the lower fragment. If such an obstruction is detected due to slight angulation at the fracture site, the nail is withdrawn to the line of fracture, the angulation is corrected and the nail is again driven into the lower fragment.

After the nail has entered the lowest femoral fragment but before it has been driven home completely, a roentgenographic check of the reduction and of the nail length is essential. The portable machine is brought to the operating room and anteroposterior and lateral films are made. These must include the fracture site and the lower end of the femur. Utmost care must be taken in covering the cassette with a sterile pillowcase and the operative site with a fresh sterile sheet which is discarded after the films have been taken.

While the films are being developed, the fracture site is protected with moist packs and a separate curved incision is made over the iliac crest. The bone is exposed subperiosteally and numerous cortical and cancellous slabs are removed from the full width of the ilium through a distance of about 2 inches. A portion of the remaining exposed cancellous bone is then removed by a curet or a curved gouge. This bone is placed around the circumference of the fracture site in generous quantity. We have used bone grafts in association with all of our intramedullary nailings. In some cases bank bone has been used instead of autogenous bone.

When the films are returned to the operating room, they are examined for adequate bone contact and to verify the proper situation of the nail in the lower intramedullary canal. It can then be determined from the proximity of the lower end of the nail to the knee joint just how much further the nail may safely be driven. If the precalculated length measurement is correct, the nail may be inserted until only the proximal 1.5 cm. including the extraction eye protrude from the trochanter.

The fracture site is then further tested for stability, especially regarding rotation. In certain instances, especially cases in which there is marked comminution or intervening butterfly fragments, supplementary internal fixation is required to produce adequate immobilization. (Fig. 4.) Use of wire loops is the method of choice and these may be placed either by drill holes through the adjoining cortices or by circumferential loops. An efficient wire tightener and a heavy 18 gauge stainless steel wire are required for this additional fixation. Occasionally an obliquely placed stainless steel screw through adjoining fracture surfaces may com-



4A 4B

FIG. 4. A, anteroposterior and lateral roentgenograms of a fracture of the femoral shaft with middle butterfly fragment; B, roentgenograms one month after insertion of dual intramedullary nails, two wire loops and iliac bone grafts.

plete the immobilization. Wire loops are preferable, however, because they do not have the tendency to produce distraction of the fragments during bone healing.

When fixation is considered satisfactory and the bone grafts have been placed, the wounds are closed in layers with interrupted chromic catgut sutures. Cotton sutures are used in the skin and a compression bandage is used on the thigh. When autogenous bone has been taken for the grafts, a small rubber dam drain is used in the iliac wound for twenty-four hours. The patient is returned to a fracture bed and the involved limb is placed in simple balanced suspension in an Army leg splint with Pearson knee attachment. Traction is never used.

Postoperative Care. The leg is maintained at an angle slightly above the horizontal to avoid edema. Occasionally swelling of the knee requires loosening of the compression bandage one or two days after the operation. Quadriceps exercises and foot and ankle motion are taught prior to surgery and are instituted the day following the operation. Sutures are ordinarily removed on the eighth day. The iliac wound is often the site of considerable postoperative discomfort but we have had no difficulty due to hematomas since the drainage has been routinely used. Knee motion is started one week after operation in the suspension apparatus by means of an overhead pulley attachment.

At the end of two weeks the limb is removed from suspension and the patient is assisted by the physiotherapist in knee movements. He remains in bed for two additional weeks although he may be up in a chair at intervals with the affected knee extended. Four weeks after operation graduated weight bearing is started under the supervision of the physiotherapist. The patient progresses rapidly from the parallel bars to crutches and then to the use of a cane. Braces are not used. At the end of six weeks from the time of operation unassisted weight bearing is usually possible and there is an excellent range of joint movement. The latter will depend to great extent on the time interval between injury and the date of intramedullary fixation. If it is short, a complete return of all joint movements may be expected from six to eight weeks from the time of operation.

Postoperative films are taken when the patient is removed from suspension and at monthly intervals thereafter. We have been impressed with the early and abundant periosteal callus formation and new bone production, much of which no doubt is in response to our generous iliac bone grafts. Endosteal callus is difficult to determine because of the nail.

There is good reason to believe that it is retarded but no evidence to suggest that this produces any deleterious effect on eventual bone healing.

In this series of patients clinical union was always present eight weeks following operation and union was noted on the roentgenograms in an average of 16.8 weeks. There has been minimal discomfort at the fracture site on manipulation and on weight bearing. Some patients complain of pain above the trochanter at the point of nail entrance and they often develop an abduction type of limp, apparently due to gluteal irritation. If this persists it can be eliminated by removal of the nail. In some cases a bursa develops over the head of the nail and this may become calcified.

Removal of the nail is a necessity only when there is discomfort or limp. However, we have recommended the removal of the nail as soon as it seems certain that solid union has been secured on the theoretic grounds that wandering of the nail into the knee joint is a definite possibility. This has not occurred in any of our cases but removal of the nail is easily accomplished by a small trochanteric incision and at the time of removal the nail is almost invariably freely movable and extracted without force. In this group of cases five nails have been removed. Others have either been maintained because they are symptomless or the patients have been transferred beyond our control.

COMPLICATIONS

There are many possible complications in the procedure of open intramedullary femoral nailing. These are incident primarily to the fact that it is an internal fixation operation and therefore exposed to the danger of wound contamination and to other complications of open operative procedures. The secondary difficulties are peculiar to the intramedullary nailing operation itself. It is obvious that the procedure should be carried out only under optimum circumstances with proper surgical facilities, adequate apparatus for any operative eventuality and by sufficient trained personnel to meet possible surgical requirements. Nails may split, bend, break, perforate the cortex, perforate the knee joint or become hopelessly jammed so that motion is impossible in either direction. They may not fit properly and immobilization may not be achieved. Undue trauma and time of operation may predispose to shock and wound infection. It is not a procedure to be regarded lightly.

We were fortunate that there were no complications in this operative series other than recurrence of thrombophlebitis. However, our experience with subsequent cases of femoral nailing and with the intramedullary nailing of other long bones has made us deeply respectful of the possibilities involved. Of our entire series to date of fifty-six femoral nailings we have had no deaths but there were two wound infections. One was in a recent fracture and the other in a patient who had an old infected fracture with non-union. Both of these fractures united and the wounds eventually healed. There was one definite non-union. If all our intramedullary nailings are considered, regardless of the bone involved and including tibias, humeri and forearm bones, there have been 105 total cases with five infections in recent fractures and one in an old fracture with osteomyelitis. There were four non-unions, one in a femur, two in the tibia and one in a radius. There was one delayed union in a tibia requiring secondary reinforcing bone graft. One tibial non-union was associated with massive skin necrosis, bone infection and eventual amputation. We are well aware of the complications which may attend the nailing procedure.

STATISTICAL ANALYSIS

Any method of fracture treatment which exposes the patient to the possible complications of open reduction and the specific complications incident to the nailing procedure itself must offer very definite advantages over skeletal traction suspension in order to warrant its use. A careful study has been made of the two groups of patients in order to determine whether such definite advantages are found to exist. Table 1 represents the essential data noted in the two groups and a comparison of the functional results.

The fractures were of approximately the same type in the two groups. There were only two open fractures in the traction group and three in the nailing series. The latter were permitted to heal before the nailing was performed. Most fractures were in the middle third of the shaft. The incidence of comminuted and segmental types was the same in both groups.

The average age of the patients was very slightly higher in the traction group. The patients in each group were males except one

individual. The military status was the same in the two groups.

Whereas the traction patients spent an average of twenty-five weeks in bed, the nailing group average was only 5.5 weeks. The prolonged average bed status in the traction series is due partially to the inclusion of the patients who required secondary operation with bone grafting. Even without these four cases, however, the average time in bed was 22.5 weeks.

TABLE 1
STATISTICAL ANALYSIS

	Skeletal Traction	Intramedullary Nailing
No. of patients	20	20
No. of fractures—Closed	19	18
Open	2	3
Age incidence	17–67 yr.	17–51 yr.
	Av. 31.4 yr.	Av. 26.0 yr.
Occupation	14 Military	14 Military
	6 Civilian	6 Civilian
Sex	19 Male	19 Male
	1 Female	1 Female
Type of fracture		
Transverse or oblique	13	10
Comminuted	7	10
Segmental	1	1
Location of fracture		
Middle	18	17
Upper third	3	2
Lower third	0	2
Time in bed	15–52 wk.	3–9 wk.
	Av. 25.0 wk.	Av. 5.5 wk.
Time in hospital	20–92 wk.	4–36 wk.
	Av. 44.1 wk.	Av. 16.7 wk.
Mortality	0	0
Duration of physical therapy	8–52 wk.	0–20 wk.
	Av. 22.9 wk.	Av. 7.3 wk.
Bone healing—primary	17	21
After secondary open reduction and bone graft	4	0
Complications	Renal—3	Thrombophlebitis—1
Knee motion		
Normal	2	18
90° or more	5	2
45°–90°	9	0
Less than 45°	5	1
Eventual disposition		
Full activity	11	19
Limited activity	9	1

The average period of hospitalization in the traction group was 44.1 weeks whereas in the nailing series it was only 16.7 weeks. Since all of the patients were either in the military service or were veterans or soldiers' dependents, the average length of hospitalization is considerably greater than would exist under conditions of civilian practice. In the case of the military, hospitalization must be continued until either a return to duty or discharge from the service can be effected. In the case of veterans and military dependents, home conditions very often prevent discharge from the hospital until the patient is self-sufficient for ordinary activity. There is, however, a startling contrast between the periods of hospitalization in the traction and nailing groups.

There were no deaths in either group. All fractures united in the nailing series, whereas with traction suspension there were four patients who required later open reduction and bone grafting. There was good recovery of knee motion (90 degrees or more) in the traction group in only seven cases whereas such recovery was noted in the nailing series in twenty. There were eleven patients in the traction group who could be returned to full activity while this was true in nineteen of the nailing series. In the traction group three patients presented renal complications due to prolonged recumbency. In the nailing series there were no wound infections and no renal or pulmonary complications. One patient had postoperative recurrence of an old thrombophlebitis.

COMMENTS

The statistical analysis of the two groups of patients, considering principally the time in bed, duration of hospitalization, time and quality of bone healing and functional results, leaves little doubt as to which method of treatment is preferable in fractures of the femoral shaft. Eliminating open fractures (until healing occurs) and fractures in the upper and lower ends of the femur, intramedullary nailing by the open method is superior in every way to treatment by traction suspension. Comparison with other methods of open reduction and internal fixation is not the purpose of this communication. All methods of operative reduction are open to the criticism that they expose the patients to added surgical risk.

Our own experience and that of others would suggest that in all appropriate femoral shaft fractures open intramedullary nailing is the treatment of choice. In our more recent experience with additional cases of intramedullary femoral nailing we have had no reason to alter our original impressions. It is, however, quite clear that there are dangers inherent to open reduction and specifically to intramedullary nailing which limit its use to certain conditions. If these conditions are not respected, the complicating factors will outweigh the obvious advantages and the method will fall into disrepute. It seems trite to offer the reminder that

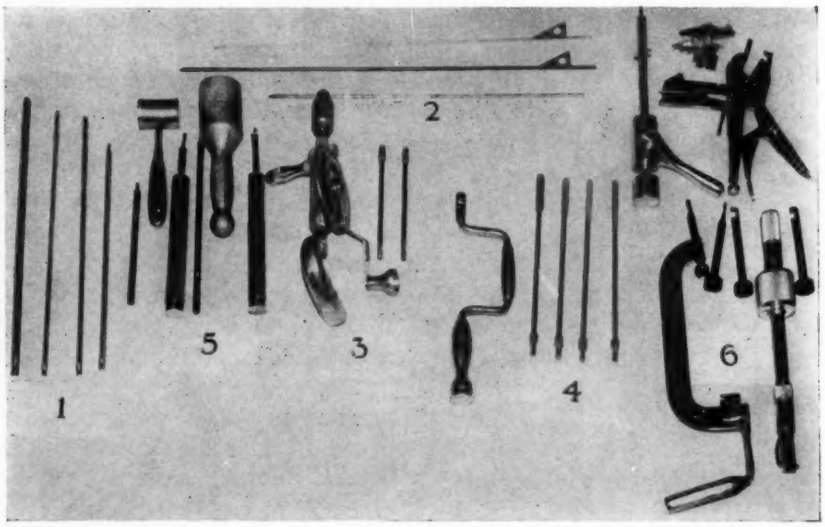


FIG. 5. Essential instruments required for intramedullary nailing of the femur in addition to complete set of bone instruments used in open reduction of fractures: (1) intramedullary nails of various diameters and lengths; (2) intramedullary guides; (3) hollow drills for trochanter; (4) intramedullary reamers of various diameters; (5) drivers and heavy mallets; (6) nail extractors of various types.

a patient with limited knee movement is in a happier state than one who has died from shock, and a patient who is forced to remain in bed for four months is better in the long run than one in whom wound infection and osteomyelitis have developed. Our antibiotics have given us comfort and have afforded the patient protection but they should not be the excuse for unwarranted surgery.

It is our considered opinion that open intramedullary nailing of certain fractures of the femoral shaft should be performed only under the following circumstances: (1) The general condition of the patient should always be satisfactory for a major operative procedure. The age of the patient is a factor. It should not be performed in children but the elderly may withstand such a procedure better than prolonged conservative treatment. (2) The operation should be undertaken only under optimum circumstances. The complete equipment required for open reduction of fractures must be available as well as a large selection of the instruments used in the intramedullary nailing procedure. There must be an assortment of nails, drills, guides and especially extractors. (Fig. 5.) Without such extensive equipment the operation should not be performed. (3) It is essential that the surgeon have adequate assistance in performing the operation. The various steps in manipulation, maintenance of reduction and insertion of the nail require many hands, preferably experienced. (4) The operation should be attempted only by those experienced in bone surgery. If performed by the unqualified the difficulties are certain to present a barrier to its general acceptance as a procedure.

Under these circumstances open intramedullary nailing of selected femoral shaft fractures offers the patient a far better prospect for early return to weight bearing and for complete recovery of function than can be given by any conservative type of treatment. In the absence of any of these four conditions treatment by means of traction suspension is strongly recommended as the method which, however economically and functionally less desirable, still presents less risk to the patient's general welfare.

SUMMARY

1. A clinical comparison has been made of twenty-one femoral shaft fractures treated with traction suspension and twenty-one such fractures treated with open intramedullary nailing.

2. The nailing procedure presents very great advantages over the traction suspension method regarding period of recumbency, duration of hospitalization, time and quality of bone healing and the functional results.

3. In selected cases, in the proper hands and under the proper circumstances the advantages

offered by open intramedullary fixation offset the risk of open reduction and the peculiar hazards of the nailing procedure.

4. If the stated appropriate conditions for intramedullary nailing cannot be met, treatment by traction suspension is recommended.

5. The management of selected femoral shaft fractures by the open intramedullary nailing procedure is described. Contraindications to the method are noted. The inherent difficulties and possible complications of the procedure are emphasized.

6. All open intramedullary nailings in fractures of the femoral shaft should be accompanied with iliac bone grafts to the fracture site. This may interfere with a true estimation of the effects of the nailing procedure on the process of bone healing but it will assure a more rapid, effective and secure bone union.

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BONE ABSCESS DUE TO SALMONELLA B. (BREDENEY)

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IN the past few years there have been an increasing number of reports of bone and joint infections due to the Salmonella (paratyphoid) bacillus. Seligman et al.[8] point out that this group of organisms is capable of producing a multitude of clinical syndromes by no means limited to food poisoning or to a typhoid-like fever. Some strains (S. suipestifer) may become invasive in character and produce parenteral abscesses involving any tissue in the body. These authors believe that many cases of infection by these organisms are not detected because of faulty bacteriologic technic.

Infection may occur either in epidemic or in sporadic isolated form. Infection of the skeletal system as reported in the literature is more apt to occur in the latter form. Infection may involve a single bone or joint or there may be multiple bone or joint involvement.

In some cases of skeletal involvement there may be no antecedent history of Salmonella infection. In other cases skeletal involvement appears within a few days or weeks following a bronchopneumonia or an unexplained febrile illness. In some cases the onset is typical of an acute virulent septicemia not unlike that produced by staphylococcus or streptococcus.

The clinical picture varies a great deal with the strain of the organism. Paratyphoid B. (Salmonella typhimurium) appears to attack chiefly bone. There is usually multiple bone involvement and the clinical picture is usually that of an acute bacteriemia not unlike that produced by the more common pyogens. Carrington and Davison[1] reported a case of multiple bone involvement in an eight year old boy. The clinical picture was that of an acute septicemia. There was no antecedent history suggestive of paratyphoid fever. The blood culture was positive for Paratyphosus B. The child apparently recovered from this infection although sequestration of some of the bones did occur. Dehlinger[2] reported a case of osteomyelitis of the spine associated with an abdominal aortic aneurysm. This patient, a sixty-nine year old man, had an acute septicemia with a positive blood culture for Salmonella B. and died of this infection.

Kraus[3] reported a case of multiple bone infection due to Salmonella typhimurium in a boy two and a half years of age. Although the blood culture was positive, the child recovered without sequestration.

Salmonella C (choleraesuis) produces a somewhat different clinical picture. Although single or multiple bone involvement have been recorded, this group appears to have a predilection for joints. Harvey[7] states that the most common type of infection by this strain is the uncomplicated bacteriemia. This bacteriemia may persist for a long time. The majority of cases are sporadic and no recognizable source of the organism in the body is usually found. The manner of entrance is unknown. Of a total of seventy-one cases collected from the literature by Harvey, there were fifteen cases (20 per cent) of bone and joint involvement. Joints of the amphiarthrodial type are particularly susceptible to this strain of organism. Harvey reported ten cases of involvement of the costochondral junction, four cases of the sacroiliac joint, two of the sternoclavicular joint and one case of involvement of the symphysis pubis. This strain is apt to be seen in the course of debilitating disease or in joints recently injured. Harvey quotes Ssokoloff who reported thirty cases of infection by this bacillus, all of which occurred as surgical complications. In this series there were five cases involving the vertebrae, three of the hip joint and two of the knee joint. Harris and Meyers[6] reported a case in a soldier involving the knee joint immediately following surgical treatment of extensive fractures of the tibia and femur. Cultures from the joint and blood were positive; however, the stool culture was negative. This patient apparently recovered from the pyarthrosis. Gordon and Shechter[9] reported a case in an adult man who had involvement of the knee following acute trauma to this knee which had been previously damaged by osteochondritis dissecans. This patient also recovered almost

FIG. 1. Anteroposterior and lateral views of lower tibia showing large area of decreased density, bilocular in appearance. The lesion extends to subchondral bone. Periosteal proliferation can be seen along the posterior cortex.

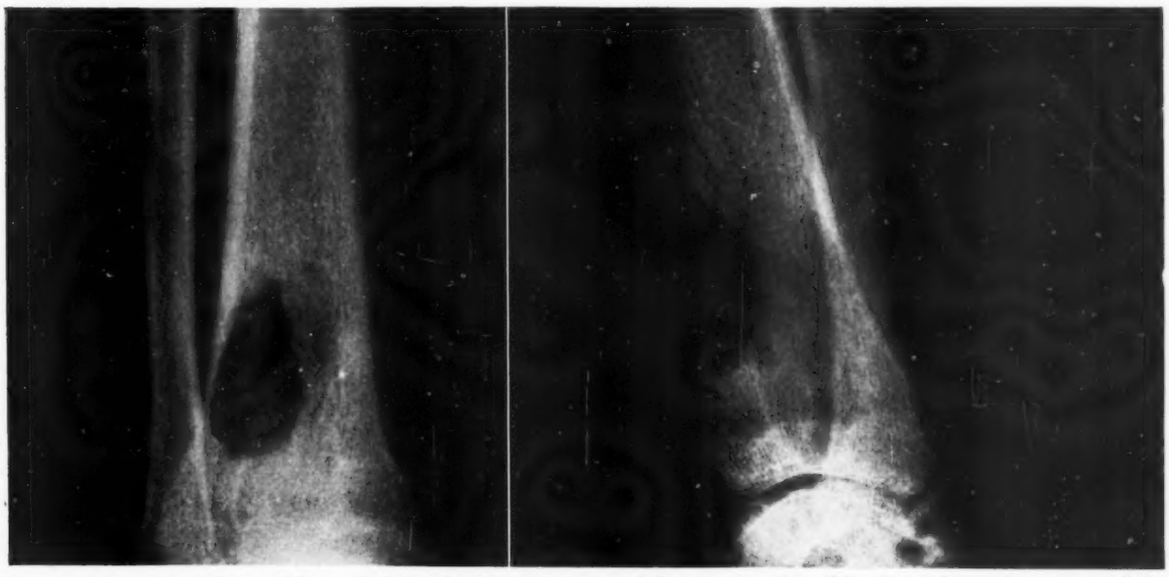

FIG. 2. Anteroposterior and lateral views showing operative defect in anterior tibia. Just above the center of the defect a rounded area of decreased density can be seen which represents the area of perforation of the posterior cortex. The periosteal proliferation along the mediolateral aspects of the tibia are more clearly demonstrated.

full function. These cases confirm the opinion of Harvey[7] that in cases of monoarticular involvement, after open drainage or aspiration, traction and immobilization, the temperature drops to normal and full mobility usually returns. Harvey reported no deaths in cases of monoarticular involvement. However, in cases of extensive and multiple bone involvement there was a high degree of mortality. Under one year of age the mortality was 28 per cent, under twenty-five years, 19 per cent and over twenty-five years, 58 per cent.

Although Salmonella B. (typhimurium) and Salmonella C (choleraesuis) are by far the most common strains involving bones and joints, other strains have been reported. Vinke and Downing[5] have reported a case of knee joint infection in a six month old child due to

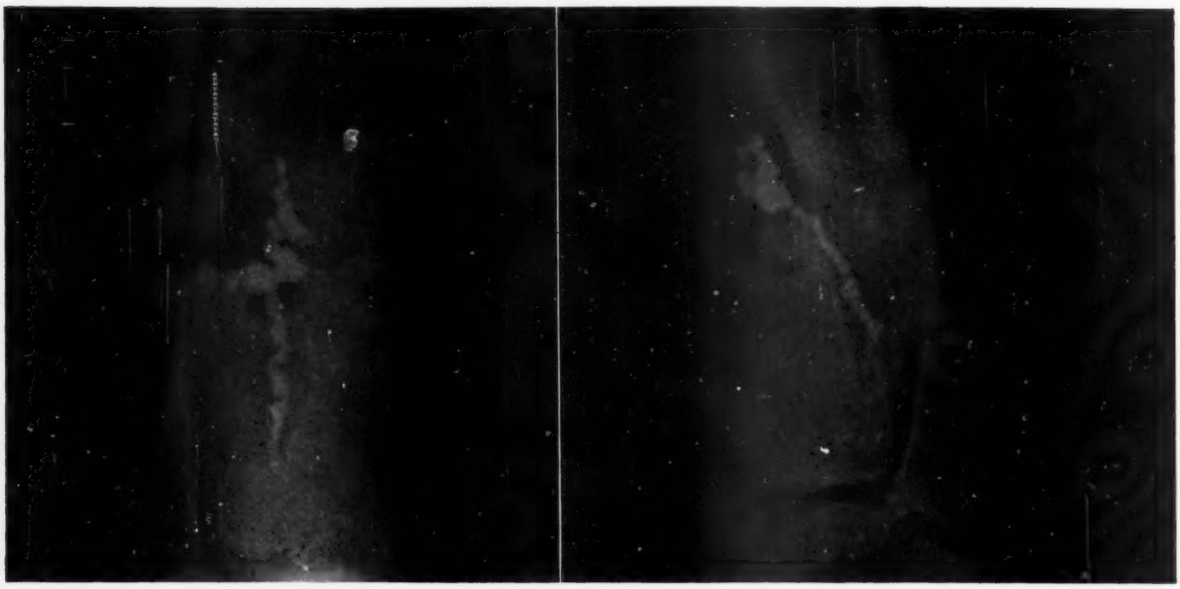

FIG. 3. X-rays taken three years later show the cavity to be obliterated but injection of the sinus with lipiodol shows persistent sinus tracts within the bone. The area of perforation in the posterior cortex is still visible.

Salmonella montevideo. One month prior to the onset the child had diarrhea for two weeks. The organism was recovered from the joint fluid but not from the stools. The child not only survived but also recovered full knee motion.

Seligman, Saphra and Wasserman[8] in a review of 1,000 cases of Salmonella infection studied at the New York Salmonella Center isolated thirty-eight different strains of this organism. They reported three cases of osteomyelitis due to Salmonella typhimurium B, Salmonella enteritidis D and Salmonella panama.

The following case is of interest in that the clinical picture differs markedly from that which has been previously described in the literature; and, further, the organism Salmonella Bredeney recovered from the chronic bone abscess has not, to our knowledge, been previously described as a cause of osteomyelitis.

G. P., age twenty-five, was seen at the South Shore Hospital in Weymouth on September 18, 1947, in consultation with Dr. James McLaughlin. The patient stated that in March, 1943, while in the Army an acute illness developed which was marked by sudden onset, high temperature and chills associated with diarrhea and vomiting. This illness lasted only a few days. Thereafter, the patient felt well and served in the European theater for one and a half years. In June, 1947, while in an army camp, he awakened one morning and found his left ankle swollen, reddened and painful. X-rays were said to be negative and he was treated for five and a half weeks with ankle strapping for a sprained ankle, although he could recall no history of injury. Thereafter, the patient had little pain except on running although some swelling of the ankle persisted. On September 14, 1947, while driving his car on a short trip the ankle again began to ache and became swollen. Within a matter of hours the pain and swelling became much worse and at the same time an acute upper respiratory infection developed. On admission to the hospital on September 17, 1947, the temperature was 102°F. and the patient stated that he felt as though he had the grippe. His chief complaint, however, was a steady ache in the left ankle.

On examination the lower left leg showed definite thickening with puffiness about the ankle joint but with no detectable fluid within the joint. There was no redness but the part was definitely hot to the touch. There was marked tenderness over the lower tibia and exquisite tenderness over the posterior lower leg.

X-rays showed a large area of decreased density in the lower tibia measuring 3 inches in length by 1 inch in diameter. The area appeared bilocular. Partially surrounding this lesion was a zone of increased density. There was slight but definite periosteal elevation on the medial, lateral and posterior aspects of the

tibia. (Fig. 1.) The appearance suggested somewhat a giant cell tumor but the clinical history and findings and the periosteal proliferation were more in keeping with a localized bone abscess. On September 30th the abscess was opened, with the escape of a large amount of yellow-green pus. The cavity was monolocular and was much larger than appeared on the roentgenograms, extending from cortex to cortex and down to the subchondral bone of the distal tibia. The walls of the cavity were smooth and there were no sequestra. The posterior cortex had eroded through and there was a large subperiosteal abscess posteriorly. (Fig. 2.) The cultures were first reported as being Salmonella typhimurium but were later identified at the National Salmonella Center in New York City as being Salmonella Bredeney. The cavity was packed with grease packs. The skin gradually closed over the cavity leaving only a small sinus which drained on occasion. Five months later the cavity was curetted and the anterior tibial cortex removed. Five days later the cavity was lined with a split thickness graft. This graft was removed two months later and the cavity packed with medullary iliac bone. Thereafter the wound healed but four weeks later a sinus appeared which has drained intermittently since. The cavity became obliterated but injection of the sinus two years later showed the presence of sinus tracts in the bone. (Fig. 3.) Cultures taken in September, 1950, showed only Staphylococcus aureus. The patient has remained symptom-free to date and has not been disabled.

SUMMARY

Attention is called to the relative frequency of the salmonella group acting as pyogenic organisms. Soft tissue abscesses, osteomyelitis or pyarthrosis may be produced. The more common strains which involve the skeletal system are the Salmonella typhimurium B which affects chiefly bone and the Salmonella choleraesuis C which has a predilection for joints. In either case the clinical picture is one of acute infection.

An unusual case is presented. This case differs from those previously reported in that the lesion was a chronic bone abscess and the infecting organism, Salmonella Bredeney B. has not, to our knowledge, been previously described as being a cause of osteomyelitis.

The portal of entry in this case is unknown. Whether the attack of diarrhea which occurred four years previously was due to paratyphoid fever and the source of the bone abscess is conjectural.

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ACUTE PERFORATED GASTRODUODENAL ULCER*

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THIS study was undertaken in order to evaluate properly the results of surgical treatment of acute perforated ulcers of the stomach and duodenum at the Southern Pacific General Hospital. The twenty-one-year period from 1927 t9 1947 was chosen because a fairly adequate follow-up was possible. The purpose of this paper is not criteria for diagnosis. This aspect was discussed in a presentation from this hospital by Washburn[73] in 1934. We included many of the cases reported by him but have endeavored to convey the follow-up studies.

From 1927 to 1947 132 patients with acute perforated ulcer of the stomach and duodenum were seen. Of this number 123 were treated by surgical intervention and nine by conservative measures.

There were 116,271 admissions during this period, of which 4,109 were for ulcers of the stomach and duodenum, an over-all incidence of 3.53 per cent. Acute perforation occurred in 132 or .113 per cent of the total number of admissions and in 3.21 per cent of the patients admitted with the diagnosis of peptic ulcer. In DeBakey's[15] collected series the incidence varied from 1.2 to 28.1 per cent.

Of the 123 patients operated upon there was only one woman (with a perforated gastric ulcer). This low incidence is accounted for, at least in part, by the small ratio of women to men treated in this institution. There is approximately one female patient admitted to nine males, with a corrected ratio of perforation in females to males of 1:14.

Houston[27] reported a preponderance of perforation in men of 15:1, Griswold and Antoncic[24] 26:1, and Berson[4] 31:1.

The ages of the surgically treated patients varied from twenty-one to seventy-four years. The oldest patient had a perforated duodenal ulcer and he recovered. The greatest number of perforations occurred between the ages of thirty-six and forty-five (Table 1.)

There were three Negroes, four Mexicans and 127 Caucasians in this series. In the data reported from the Charity Hospital in New Orleans[15] it was found that acute perforated ulcer occurred almost as frequently in the Negro as in the white race.

TABLE 1
PERFORATION IN EACH AGE GROUP

Ages	Cases	%	Ages	Cases	%
20–25	6	4.77	51–55	21	16.92
26–30	4	3.15	56–60	12	9.25
31–35	14	11.36	61–65	6	4.77
36–40	23	18.7	66–70	1	0.81
41–45	23	18.7	71–75	1	0.81
46–50	14	11.36			

A number of authors (MacKinnon, Allen and Walsh[35]) report a higher incidence of perforation in the spring, autumn and winter, with the lowest incidence during the summer months. MacKinnon[35] noted that in Minnesota upper respiratory infections were frequent in the late autumn, winter and early spring. Ulfelder and Allen[35] also recorded a close relationship with this factor of upper respiratory infection. Moore[40] reported a marked seasonal difference in New York. In his New York Hospital series perforations occurred twice as frequently in the winter months in contrast to the summer season, a ratio of 21:10; in the Bellevue Hospital series this ratio was 33:20. We found no such seasonal deviation in our group. There was a variation between four in February to a high of twenty-one in August.

MacKinnon[35] determined the hour of perforation in 172 cases. Only four patients had perforation while eating. Most of the perforations occurred when the gastric secretions were presumably not neutralized by food and thus were more highly acid.

Occupations of the 132 patients were as follows: clerical, twenty-two; laborer, seventy-

* From the Southern Pacific General Hospital, San Francisco, Calif.

nine; supervisory, twenty-four, and administrative, seven.

Of the 123 cases in which treatment was surgical thirty-seven perforations (30.08 per cent) were gastric and eighty-six (69.9 per cent) were duodenal. Of the gastric cases

TABLE II
SEASONAL INCIDENCE

	Cases	%
Spring	33	24.63
Summer	47	35.08
Fall	31	23.13
Winter	23	17.6
	Collected Series (DeBakey)	
Spring	..	28.6
Summer	..	22.4
Fall	..	23.9
Winter	..	25.0

twenty were classified as in or near the pylorus; nine, lesser curvature; five, anterior wall of the stomach; and three, posterior wall of the stomach. All of the duodenal perforations were on the anterior wall.

The greatest number of gastric ulcers occurred between the ages of fifty-one and sixty years (fifteen cases) while the greatest number of duodenal ulcers were in a lower age group, thirty-six to forty-five years (thirty cases). However, the youngest patient (aged twenty-one) had perforation of the stomach and the oldest patient (seventy-four years) had perforation of the duodenum.

There was a higher mortality rate in the gastric group, nine of thirty-seven patients or 24.5 per cent as compared to a mortality rate in duodenal perforation of ten in eighty-six or 11.6 per cent. There was a total of nineteen deaths in the 123 patients operated upon or 15.4 per cent.

As has often been brought out, comparison of mortality figures in different types of hospitals cannot be adequately made; because when one has a close liaison with patients in a tightly knit community, the patients will be seen earlier. This is illustrated in the results reported by Baritell[1] in 1947, 1.1 per cent mortality in a series of eighty-eight cases, and in the report of Wakely[71] in 1944. The latter followed up 103 cases in a ten-year period from the Royal Naval Hospital at Haslar where the case fatality rate was 8 per cent. This was contrasted with hospital and private practice for the same period when 102 patients were treated, with a mortality figure of 20 per cent. In the Royal Navy series the patients' average age was thirty-two years and in the civilian group the average age was forty-six. Forty-four per cent of the patients with peptic ulcer were still serving in the Royal Navy from nine to twenty years following perforation. Of the civil cases 20 per cent of the patients were with the armed forces, the longest case twenty years after perforation. Wakely concluded that patients who have had perforated ulcers should not be invalided from the service. The treatment he describes is that of gastric suction and simple suture. Sulfanilamide was used locally but no drainage.

In an analysis of time between perforation and operation, ranging from one and one-half to seventy-two hours, the mortality rate was much lower when operation was performed in the earlier hours after perforation. Other factors, however, must be weighed because the time factor did not seem as important in younger men in previously good physical condition.

There were fifty-seven admissions with five deaths, a mortality of 8.77 per cent, in the time period up to six hours. Of the deaths in this group, one patient was thirty-four years of age and the others ranged between forty-seven and fifty-three years. In the period from six to twelve hours thirty patients were operated upon with five deaths, a mortality of 16.68 per cent.

There was an increase in the mortality rate with increasing time between perforation and operation except in the twenty-four to forty-eight hour period when there were four operations with no deaths. However, the patients in this group were all young men twenty-eight to thirty-six years of age in good physical condition.

Three ulcers perforated in the hospital. One patient had perforation while undergoing barium series and the diagnosis was made at that time. Another patient, the only woman in the group, had severe pain upon returning to the ward after x-ray examination. At operation barium was extruding from a perforation in the anterior wall of the stomach. The third patient died, the only one who did not have barium by mouth.

Previous history of ulcer or ulcer-like distress

bore no relationship to the outcome in our series. Of 113 cases in which the histories were unequivocal fifty-eight or 51.3 per cent had symptoms one year or longer (one to twenty-five years). Twenty-six or 23 per cent had symptoms less than one year, varying from four days to six months. Eighteen or 15.9 per cent had no previous symptoms. In eleven there was an indefinite period of symptoms.

REPERFORATION

Seven cases were accepted as having had two perforations. However not all were proved at operation. Also, one patient is included who had the first perforation of a duodenal ulcer in 1925 before this series was started. Twenty years later he was treated at this hospital with a diagnosis of probable reperforation. He refused operation and recovery ensued.

Another patient was seen here for the second perforation of a duodenal ulcer in 1949, two years after the first perforation which was repaired at another hospital. Simple closure was employed each time. Subtotal gastric resection was advised following recovery from the second operation but this was refused by the patient.

A third patient had repair of a perforated ulcer which was considered to be pyloric in position. Two years later he had a second perforation which was diagnosed at operation as duodenal ulcer. It is now thought more likely that this was reperforation of a duodenal ulcer, as we all know that it is sometimes difficult to determine the exact site at operation. This patient also refused the advice of subtotal gastric resection as an elective procedure.

Another patient had simple closure of a duodenal ulcer in 1941 and again in 1944, with ulcer symptoms in the interim. In 1947 he had subtotal gastric resection since which time he has been well.

The fifth patient was operated upon for a perforated pyloric ulcer in 1941 and seen here with a second perforation in 1944, twenty-six and one-half hours after perforation. Operation was not deemed advisable and he died on the seventh hospital day. During the time in the hospital he was treated by gastric suction and supportive measures. At autopsy a perforated prepyloric ulcer with peritonitis was found.

The sixth patient had simple closure of a perforated pyloric ulcer in 1939. What was thought to be a second perforation in 1942 was treated conservatively with gastric suction. The patient recovered completely and had five well years. He died twelve days following combined abdominoperineal resection of the rectum for carcinoma.

The seventh patient had what was described as gastric perforation on the lesser curvature in 1941 repaired by simple suture. Five years later he was successfully operated upon for a duodenal perforation.

At first glance this reperforation rate of 5.3 per cent seems high. Turner[15] in 1925 reported an incidence of 0.7 per cent in 147 cases, and Shelley[53] and Read,[49] respectively, reported 3.7 and 4 per cent. Pearse[45] found thirty-three reperforations in reports of 4,183 cases from the literature or an incidence of 0.69 per cent. In a series of twenty-four cases of reperforation treated by simple suture only one patient had more than two perforations; but five of eight patients who underwent gastroenterostomy in addition had perforations three or more times. There was a jejunal ulcer in three of these; two of the three patients who died had primary gastroenterostomy.

Lysaght and Williams[34] in 1937 reported a case of ulcer that had perforated four times in four years. After the second perforation a posterior no-loop gastrojejunostomy was performed. Three months after the fourth perforation subtotal gastric resection was necessary for marginal ulcer. As this was the fourth time in these authors' experience that anastomotic ulcer formed after gastroenterostomy, they advised that if simple suture is not enough subtotal gastric resection should be performed. We heartily agree with this viewpoint.

Cohn[13] (1941) reported twelve reperforations in 300 cases of perforated petpic ulcer at the San Francisco Hospital, an incidence of 4 per cent. One patient who had a third perforation had gastroenterostomy. Subtotal gastric resection was performed upon two patients at the second perforation, with one death. The others were treated by simple closure.

In Moore's[41] Bellevue series, reperforation occurred in 5 per cent, and in the New York Hospital series there was an incidence of 5.8 per cent.

There were ten patients with perforations who were not operated upon. Five of these lived. Of this group, the time of perforation was not stated in one. This patient refused operation and lived although pneumoperitoneum was demonstrated on x-ray. The

patient has not been well for six years, with epigastric pain and recurring tarry stools. X-ray still demonstrates duodenal ulcer after six years. This patient was treated without benefit of gastric suction during hospitalization.

A second patient had symptoms of probably less than six hours on admission. It was thought that there was air under the diaphragm in the left lateral decubitus position. The patient was not well three years later. He also had no gastric suction.

The third patient was previously mentioned as having had a perforated duodenal ulcer repaired at this hospital in 1925. At the second admission twenty years later he had had symptoms for twenty-four hours. He refused operation and was treated by gastric suction. This individual has been well for four years.

The fourth patient probably had a second perforation of a duodenal ulcer two and one-half years after a first perforation with operation. The second perforation occurred ten days previous to admission. He was treated by gastric suction and recovered.

In the fifth patient perforation had probably taken place two days before hospitalization. He was treated conservatively and recovered. X-ray at a later date revealed duodenal ulcer. The patient was living and well seven years later.

It is of interest to note that in two of these people gastric suction was not employed, and in two others it was not employed until two and ten days respectively had elapsed, yet the patients recovered.

Of the five patients who died one had tabes dorsalis with a neurogenic bladder. On the day preceding admission he noted that upon catheterizing himself he obtained no urine. He died of peritonitis twelve hours after entering the hospital. Autopsy revealed the perforation to be on the posterosuperior surface of the stomach 2 cm. above the pyloric ring.

Three patients were admitted virtually in extremis with a history of perforation over twenty-four hours previously in two and over forty-eight hours in the third. All died of peritonitis, one fifteen minutes after admission to the hospital, another on the third hospital day and the third on the seventh hospital day. The last patient had had closure of a perforated pyloric ulcer four and one-half hours old in June, 1941. On this admission, two years later, symptoms were of twenty-six and one-half hours' duration. His treatment included gastric suction.

In the fifth patient perforation had occurred twelve hours previous to entrance to a hospital in another city. He remained in that hospital for seven days previous to removal to the Southern Pacific General Hospital. He died 183 days after entrance here. Autopsy revealed perforated gastric ulcer with perigastric abscess and peritonitis.

Visick[69] (1946) treated every case of perforated ulcer conservatively over a twelve-month period. There were fourteen cases in all, but one patient was operated upon seven hours after perforation because he was not doing well. This patient died as did two others. These cases were all less than six hours old at the time of admission, except the case in which the patient was operated upon and another in which sixteen hours had elapsed between perforation and entrance to the hospital.

Visick's technic of decompressing the stomach consists of intermittent suction at intervals of one and one-half hours. Although he thought that conservative treatment of perforated ulcer is to be considered, he believed that acute perforations can be prevented by more aggressive surgery for chronic peptic ulcers that do not respond to medical treatment. By this means he claimed that the incidence of acute perforation in York had fallen 44 per cent in two and a half years while the mortality of acute perforation had remained at 22 per cent.

It is interesting to note that Visick stated a patient who has had reperforation of an ulcer should undergo radical gastric resection (at least 90 per cent). He cited a case in which he performed an emergency two-thirds gastrectomy on a man who was suffering from his third perforation. One year later a stomal ulcer developed for which very radical resection was performed. This eliminated free acid and the patient became symptom-free. Visick believed that it would have been better to treat the third perforation conservatively and then perform radical resection several weeks later.

Taylor[64] reported the up-to-date figures on aspiration treatment of perforated ulcer in which he also believes that constant suction should not be relied upon but that aspiration should be done at regular intervals. Visick[69] and Taylor[63] both stressed the use of radiopaque tubes so that the position in the stomach could be readily observed by radiography. A total of

555 patients treated throughout the world was presented with only forty-four deaths. Twenty-two of these were hopeless on admission.

Stead[59] agrees with Visick and Taylor that continuous suction is less efficient than repeated aspiration. Although we have had no occasion to try periodic aspiration, we disagree wholeheartedly with the idea, believing that to keep the stomach completely decompressed at all times is the most important single factor if one is to use conservative treatment.

Stead stated that when conservative treatment is successful aspiration greatly relieves the pain, the patient becomes comfortable and abdominal rigidity diminishes in extent and degree, receding from the left to the right iliac fossa and then up the right side of the epigastrium. As indications for abandoning conservative treatment he lists persistent and recurrent severe pain with extension of area of tenderness and rigidity. He states that these indications are more reliable than the pulse and temperature. Four patients were operated upon because progress was unsatisfactory, and in two of these the perforation appeared to be unsealed at operation. The patients made good recovery.

Of the fifty patients treated conservatively there were five deaths or 10 per cent but four of the patients who died were considered unfit for operation.

In discussing Taylor and Stead's articles in the *Lancet* Shepherd advised "the cautious attitude." He stated that he has seen the failure of "plastic fibrinous reaction to take place in early or late perforations." As will be brought out later, when gastric suction is used early and with the use of antibiotic drugs, the operative mortality can be kept at a low rate, certainly less than 5 per cent.

As we have been impressed with the failure of this reaction to take place, we believe that with the drugs now available it is not wise to procrastinate when the patient is seen early and is in good condition.

DIAGNOSIS

Diagnosis is relatively easy in the typical case. The onset is usually sudden with little vomiting or change in temperature or pulse. The pain does not vary and one notices that the patient usually lies still. The marked abdominal tenderness and rigidity are very dramatic and need no comment except that recently we saw a patient with pneumonia sent to the hospital with the diagnosis of ruptured peptic ulcer with generalized board-like rigidity which remained for thirty-six hours. The patient made a good recovery in response to antibiotics.

The familiar radiation of pain to one or both supraclavicular areas may or may not be present in perforated peptic ulcer. Raw[48] in a series of 312 cases stated that this occurred in 60 per cent. He found the clinical sign of diminished liver dullness to be dangerous and misleading. The presence or absence of liver dullness was mentioned only a few times in our patients so it could not be evaluated.

Of 335 cases Souttar[57] found profound shock in only 6 per cent. It did not occur at any particular time during the disease and was not dependent upon the size of the perforation or the amount of fluid in the abdomen. If it occurred late in the disease, he stated peritonitis should be suspected, and in early cases, hemorrhage, cardiac failure and early peritonitis.

X-ray demonstration of pneumoperitoneum is extremely helpful when found, but when not seen we have believed that it was of little value. However, x-rays were taken in only nineteen of the 123 operative cases or 15.45 per cent. Free air was found in eleven of these, or 58 per cent, and none in eight, 42 per cent. Of the eleven patients in whom pneumoperitoneum was found seven lived and four died, a mortality of 36.36 per cent. Of the eight patients in whom no free air was found seven lived and one died, a mortality of 12.5 per cent. The death in this group occurred in a patient in whom there was perforation forty-eight hours before admission. He died three months following operation for nephrosis.

Of the patients demonstrating fluid level on x-ray five were seen up to six hours following perforation and all lived. In one of these cases perforation occurred as barium was being given, and the diagnosis was made at fluoroscopy. Three patients were seen between six to twelve hours; two died of peritonitis, one patient twelve hours and one patient three days postoperatively. One patient seen between eighteen to twenty-four hours after perforation died of lower nephron nephrosis six days postoperatively.

In the cases in which no air was demonstrated roentgenologically complications were considerably fewer. One case of suphrenic abscess occurred which was drained successfully.

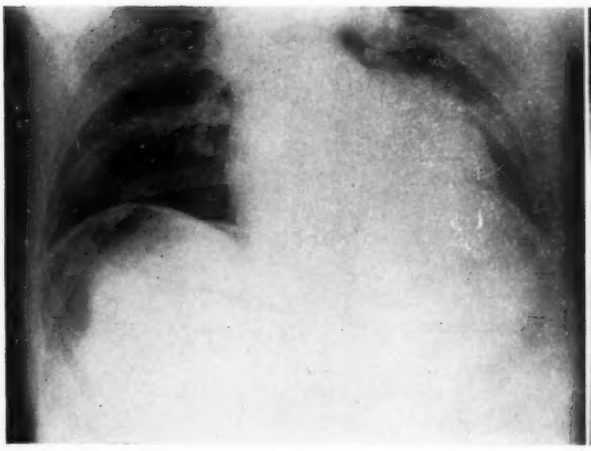

FIG. 1. Flat plate of abdomen; upright position.

FIG. 2. X-ray of abdomen in the left decubitus position.

In the patients with demonstrable pneumoperitoneum there was one abscess of the lesser sac and one subdiaphragmatic abscess, both of which required drainage. The latter necessitated drainage of an accompanying empyema. Both individuals lived. There was also a case of gastric fistula in this group which later necessitated repair.

The routine method of use of the x-ray here has been with the patient in the upright position. However, satisfactory films may be obtained with the patient in the left lateral decubitus position, when the air will be seen between the liver and the abdominal wall. The patient should assume the left lateral decubitus position for fifteen or twenty minutes before the picture is taken. (Figs. 1 and 2.)

A relatively small number of patients were studied postoperatively by x-ray with the barium meal. Of eighteen cases in which no x-ray was taken preoperatively there were positive findings of ulcer postoperatively. In seven cases no x-ray study was made preoperatively but x-rays after the operation were negative for ulcer.

The x-ray was positive preoperatively (air under diaphragm) and also postoperatively (evidence of ulcer by barium meal) in three cases. The x-ray was negative preoperatively but positive postoperatively in one.

TREATMENT

Senn[52] noticed in postmortem examination of specimens following operation upon the intestines that the omentum was adherent at the suture site in bowel anastomoses and that perforation never took place where the bowel was protected in this way. He then did experimental work on dogs, consisting of transplantation of omental flaps from which evolved "omental grafting."

Bennett,[6] acquainted with Senn's work to which he referred, used an omental plug in repairing a perforated ulcer that he could not close by the usual reparative procedures then in vogue. He reported a case from St. George's Hospital in which he turned up a portion of omentum and pushed it into the perforation "to completely close it like a cork." In discussing this Bennett emphasized pushing the omentum into the defect rather than laying it over the opening and suturing it into place as Senn advised in his omental graft. It is of interest that no irrigation and no drainage of the peritoneum was used.

Mayo and Fitchett[36] reported results in 160 patients with a mortality of 12.5 per cent. Their conclusion was that simple closure of acute perforation is the treatment of choice.

The method of choice at the Southern Pacific General Hospital has been simple closure. Until recent years this usually entailed purse-string sutures of chromic catgut, sometimes in two or three layers with a free piece of omentum sutured over the area. Sallick[50] in reporting a series of seventy-four cases noted that with the three-layer closure it appeared at the time of operation that there was constriction in many but no interference with the patency of the pylorus developed. Our figures bear this out as there were only three cases in which obstruction developed and subsequent gastroenterostomy was necessary.

One patient who had simple closure of an

ulcer at the incisura angularis was seen five years later with evidence of bilateral metastatic pulmonary carcinoma and pathologic fracture of the right hip. We have no reason to believe that this arose from unrecognized gastric carcinoma but do believe that biopsies should be taken of ulcers involving the stomach.

In 1937 Gatch and Owen[20] described their method of closing perforated ulcer of the duodenum by suturing the prepyloric portion of the stomach to the uninvolved duodenal wall distal to the site of perforation. In two of our cases of perforated gastric ulcer this principle was used.

Since January, 1947, we have closed most perforations of the stomach and duodenum after a modified method of Graham[22] described in 1938. The perforation is traversed by Lembert sutures placed parallel to the long axis of the bowel, including all layers except the mucosa. A piece of attached living fat, preferably from the gastrohepatic omentum, is placed over the perforation and the Lembert sutures tied loosely over this simply to cover the hole. However, we have not hesitated to fold the tip of the greater omentum up over the perforation and tie the sutures over it. The results have been satisfactory.

We believe that one of the most important steps in the treatment is the insertion of an indwelling nasal catheter and the institution of gastric suction as soon as the diagnosis is made. This should remain in place following operation until there is active peristalsis.

In a recent case not included in this series it was considered necessary to close a duodenal ulcer by a purse-string suture because gastric suction was not satisfactory and bile continued to exude into the peritoneal cavity after simply closing the perforation with living omental fat as previously described.

We have not used the free omental grafts suggested by Graham and other authors because we feared the danger of infection. Price and Lee[46] used both free and living fat tabs of omentum to cover holes made in the stomachs of dogs. They found that living fat could be used to cover larger defects and that free omental transplants tended to perforate and leak because of digestion of the fat tap deprived of its blood supply.

Cohn and Mathewson[14] treated ten patients successfully by continuous gastric suction. They state that it is justifiable to delay operation when peritonitis is apparently localizing and the patient is improving clinically. They admit, however, that it is difficult to evaluate improvement and select patients for conservative treatment. They are able to demonstrate air under the diaphragm in 85 to 90 per cent of their cases of perforation. They state that absence of air by x-ray suggests that the perforation is sealed off, and further, that with no demonstrable free air in a patient improving clinically it is safe to start with nonoperative treatment.

Wangensteen[72] also believes that it is safe to treat patients conservatively in whom no evidence of perforation is found on x-ray examination. Although our results were better when no air was demonstrable by x-ray, we have found the perforation gaping and unsealed at operation. We have not been impressed by the effectiveness in walling off by the unaided omentum or the fibrinous sealing of the perforation.

McElhinney and Holzer[37] in a series of 336 cases of acute gastroduodenal perforation from the Cincinnati General Hospital had thirty-eight patients with perforations over twenty-four hours old when admitted to the hospital. Fourteen were operated upon, of whom only four lived, a mortality of 71 per cent. Twenty-four were treated without operation, of whom sixteen died, a mortality of 66 per cent. From this they concluded that perforated ulcers of over twenty-four hours' duration had a poor prognosis with or without operation.

Hard and fast rules cannot, of course, be laid down because of the variables encountered in this condition, but we believe that early operation is the only safe method.

Absorbable suture material was used within the abdomen in all of these cases except twelve. Non-absorbable suture material, preferably wire, has been popular the past four years in the closure of the abdominal wall.

Drainage. In the earlier cases drainage consisting of from one to three Penrose drains to the peritoneum was used almost routinely. Drainage extending into the peritoneal cavity was done in twenty-two cases but since 1940 drains have been used on only two occasions. With the antibiotics now in use the incidence of serious wound infection has decreased to zero.

Anesthesia. Spinal anesthesia has been the anesthetic of choice at this hospital for many

years. Recently the trend has been toward inhalation anesthesia, preferably by the intratracheal route. Spinal anesthesia was used in forty-nine cases with six deaths and in combination with other anesthetics in eleven cases. Gas, oxygen and ether were used in forty-three cases with ten deaths. Nitrous oxide and oxygen in combination with ether and pentothal sodium were employed in only a few cases. Local anesthesia has been used only occasionally, and usually in combination with other anesthetics.

Prevention of Pulmonary Complications. One must be careful not to oversedate the patient. Morphine should be used sparingly and it is rarely necessary to give a dose greater than ⅙ gr. It should not be given "by the clock" and the drug is seldom necessary for more than twenty-four or thirty-six hours postoperatively. Codeine may then be used if necessary for a few days.

The patient should be instructed to breathe deeply and to cough and expectorate frequently. It is important that the patient's position in bed be changed at regular intervals and we heartily believe in early ambulation the first day postoperatively.

DEATHS NOT RELATED TO PERFORATION

Coronary disease 1
Gastric ulcer 4 yr. postoperatively

Bronchiogenic carcinoma 1
Ruptured duodenal ulcer 4½ yr. postoperatively

Carcinoma of prostate 1
Perforated duodenal ulcer 6 yr. postoperatively

Superior mesenteric thrombosis and liver abscess 1
4 days after cholecystectomy
(Cholecystectomy was performed 10 mo. after closure of gastric perforation)

Brain tumor 1
Duodenal ulcer 12 days postoperatively

Nephrosis 1
Perforated duodenal ulcer 3 mo. postoperatively

Cerebrovascular accident 1
Perforated duodenal ulcer 2 yr. postoperatively

Lymphosarcoma, oropharynx 1
3½ yr. following closure of duodenal perforation
Stomach and duodenum normal at autopsy

8/27/43 closure duodenal perforation
10/7/43 acute empyema, gallbladder drained
10/26/43 subtotal gastric resection for stenosis

Carcinoma of rectum 1
(Died 12 days postoperatively)
Duodenal perforation closed 5 yr. before
Probable second perforation 2 yr. before

Metastatic carcinoma, right hip, and bilateral pulmonary metastasis 1
Source not determined
Perforation ulcer at incisura angularis 5 yr. before
Patient did not die at this admission but logical assumption is that he did soon afterward

FOLLOW-UP STUDIES

Adequate follow-up studies were obtained in seventy-nine cases. Thirty-six patients (45.5 per cent) were well for from six months to twenty years. The number of patients symptom-free up to six months was one; six to twelve months, none; one to five years, eight; five to ten years, sixteen; ten to fifteen years, five; fifteen to twenty years, six. Postoperative gastrointestinal series was carried out in nine of these. None showed evidence of ulcer. Forty-three or 54.5 per cent were not well for from six months to twenty years. Three were not well from six to twelve months; twenty-four, one to five years; ten, five to ten years; four, ten to fifteen years; and two, fifteen to twenty years.

In this group pain was the most frequent complaint, occurring in twenty-six cases. Pain associated with hemorrhage was the chief complaint in five, pain and obstruction in three, simple bleeding in four, and obstruction alone in four. Only one patient reported improvement in symptoms with conservative treatment after one year and then remained well for three years.

A postoperative gastrointestinal series was obtained in seventeen of this group. Ten showed definite niche of duodenal ulcer, four presented a deformed and spastic bulb and four demonstrated obstruction.

Of the patients complaining of pain and obstruction, two were treated by gastroenterostomy with good results. When this study was started, it was thought that a much larger

number was cured by the method of simple closure.

As has been repeatedly brought out in the literature (Graham,[21] Guthrie,[25] Trout[15]), the preferred treatment in this country of acute perforated ulcer is by simple suture. Added gastroenterostomy brings the danger of the additional complication of marginal ulcer.

Illingsworth, Scott and Jamieson[28] reported 880 cases from the Western Infirmary of Glasgow between the years 1938 to 1943. There were 880 cases, with 733 survivors (83 per cent). They were able to trace 666 and 596 had follow-up examinations. In all but ten treatment was simple closure, these ten having an added gastroenterostomy.

They found that remission of ulcer symptoms after perforation was seldom of long duration. Forty per cent had relapsed in one year, and after five years 70 per cent had relapsed. Major complications, perforation and hemorrhage were 20 per cent within five years of perforation. Harrison and Cooper[26] reported a high incidence of recurrence of 82.5 per cent. European surgeons have long championed primary gastric resection. In this country Strauss[62] and Bisgard[9] have been the chief advocates of this method, maintaining that the patient has a greater chance of permanent cure. DeBakey,[15] however, in his extensive study of the world literature, concluded that one-fifth of the patients treated by subtotal gastric resection would still have symptoms. Simple closure is no doubt the safest procedure except perhaps for the most finished technicians.

If the patient continues to have symptoms, however, subtotal gastric resection should be performed as an elective procedure as far as the perforation is concerned.

Until January 1, 1949, subtotal gastric resection had been performed in eleven cases, the first on April 29, 1942. There was one death forty-four hours postoperatively due to pneumonia, for a mortality of 9.09 per cent. The indications were as follows: perforations two, intractable pain five, obstruction three and massive hemorrhage one. In the survivors the results have been excellent. However, the follow-up period is inadequate to draw conclusions.

SUBSEQUENT CASES

Between December 31, 1947, and July 1, 1951, twenty-eight additional patients have had perforations. Of the twenty-eight, five had gastric ulcers and twenty-three had duodenal ulcers. One of these patients, another woman aged forty-three, had a perforated ulcer located on the anterior wall of the stomach at the anterior margin of the lesser curvature just above the pyloric ring. She was operated upon nineteen and one-half hours after perforation. X-ray examination revealed a tremendous amount of air under the diaphragm and at operation there was purulent fluid. There was a gaping ulcer 2 cm. in size with no evidence of sealing off although the patient had been watched for twelve hours and treated by continuous gastric suction. On April 10, 1950, she underwent subtotal gastric resection for continuing symptoms. One year later her condition was satisfactory.

Since January 1, 1949, subtotal gastric resection has been carried out in three additional patients who had continuing symptoms after simple closure of perforated ulcers. In one the lesions were on the anterior gastric wall near the pylorus and in the other two they were located on the anterior wall of the duodenum just beyond the pyloric ring. There was no mortality. Thus there have now been fifteen subtotal gastric resections with one death, a mortality of 6.67 per cent.

The ages of the twenty-three patients with duodenal ulcer averaged 41.04 years; that of the gastric ulcer patients was 57.6 years. Time between perforation and operation varied from one to twenty-four hours, with an average of 10.08 hours. Time of perforation could not be ascertained in those who were first treated elsewhere. One of these patients, previously undiagnosed, was seen here with a duodenal fistula leading to a subphrenic abscess.

Another patient, a physician, had had perforation two days before admission. Fifteen days after admission incision and drainage of a subphrenic abscess were performed, at which time 700 cc. of sterile green pus were evacuated. Uneventful recovery ensued. In the other twenty-one cases of perforated duodenal ulcer simple closure was carried out as heretofore described, with no deaths.

Of the five gastric ulcers one occurred in a Negro male seventy-three years of age. On admission approximately six to seven days after perforation the patient was dehydrated and mentally disoriented. Surgery was performed because of a strong suspicion of strangulated bowel. A 2 cm. perforation, unclosed,

was found on the anterior wall of the stomach in the prepyloric area near the lesser curvature. The patient succumbed to peritonitis twenty-four hours later. Postmortem examination revealed the lesion to be benign.

The mortality rate among the gastric perforations was 20 and 3.57 per cent in the entire gastroduodenal group. There was no mortality in the twenty-three cases of perforated duodenal ulcer.

As brought out in an editorial in the *Lancet*,[30] one cannot compare results of conservative treatment against surgery in the years before penicillin and other antibiotic drugs were available, improvement in anesthesia and early rising after operation. With the enthusiasm for conservative treatment it may be well to remember that of 155 patients treated by operation at the Central Middlesex Hospital in England in the past thirty years there were only two deaths.

CONCLUSIONS

1. Simple closure is the procedure of choice up to twenty-four hours but each case must be considered individually.

2. Antiobiotics have helped to lower mortality in recent years.

3. If conservative therapy seems to be indicated when the patient is first seen, it is still a surgical problem and the patient should be followed up by a surgeon.

4. Patients who have had perforated peptic ulcer should be followed closely; and if symptoms persist or recur, gastric resection should be considered, usually as an elective procedure.

SUMMARY

A series of 160 cases of perforated peptic ulcer from the Southern Pacific General Hospital has been presented. Of this number 149 (94.4 per cent) were treated surgically, consisting for the most part of simple closure. The remaining eleven (5.6 per cent) were treated by conservative measures. For the most part impression at operation was the inadequacy of the peritoneum in sealing off the perforation, particularly the gastric.

Gastric ulcers appeared to occur in an older age group and to be associated with a higher mortality rate (ten of forty-two or 23.8 per cent) than the duodenal perforations (ten of 109 or 9.2 per cent). For the total number of patients treated (151) there were twenty deaths or a mortality rate of 13.24 per cent.

Since the advent of the routine use of adequate amounts of penicillin in this hospital in May, 1946, until July, 1951, there have been only two operative deaths in thirty-eight perforations, a mortality of 5.26 per cent. One of these occurred in a seventy-two year old Negro operated upon six to seven days following perforation and found to have massive intra-abdominal abscesses.

The last twenty-three duodenal perforations have been treated surgically without a single death.

Subtotal gastric resection has had to be carried out in fifteen patients in this series because of continuation of symptoms, namely, pain or obstruction. There was one death in this number, a mortality rate of 6.6 per cent. Satisfactory results have been obtained in the remaining fourteen cases.

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Follow-up results on operations for megacolon are not always satisfactory. Some surgeons still believe colectomy gives the best results. Recently Toennis and Herink reported on eleven patients in whom results were satisfactory although only sympathectomy was performed, denervating the inferior mesenteric artery and resecting the presacral nerve. Even though dilated loops of colon were still present according to postoperative x-ray studies, bowel function had returned to normal. (*Richard A. Leonardo, M.D.*)

THE ROLE OF CHRONIC PERFORATION IN INTRACTABLE MASSIVE PEPTIC ULCER HEMORRHAGE*

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THE problem of hemorrhage, the result of benign peptic ulceration, has long been of great interest to both the surgeon and the internist. Few surgeons are desirous of performing emergency gastrectomy because of peptic ulcer hemorrhage, yet this must be done at times or death is certain. It is a medical tragedy for any patient to die of a surgically controllable peptic ulcer hemorrhage. Ideally, all patients with ulcer hemorrhage treated medically should survive while the surgeon should operate only on those patients with intractable bleeding. The surgical mortality, therefore, should be the mortality of the surgical procedure in patients of a specific age group and general condition.

Large series of cases have been analyzed and much thought has been given to methods of determining which patient requires emergency surgery and which one will respond to medical management. The factor of age has been shown to be important in this decision.[1] Finsterer's[2] "golden hours" referred to the time which elapsed after the onset of the hemorrhage, the first forty-eight hours being considered the golden or optimum ones for recovery under surgical treatment. We have all learned through bitter experience that patients who have had recurrent massive hemorrhage with the resultant episodes of anoxia reach a stage of irreversible systemic damage. These individuals in most instances cannot survive even the simplest surgical attack on the source of their bleeding. Since the development of blood banks and massive blood replacement, continued or recurrent bleeding has become the foundation for the decision for emergency gastrectomy. The ability to replace blood in large quantities gives the physician an opportunity to let the patient prove that operation is imperative without undue risk of death from hemorrhage during this period of observation. As emphasized by Dunphy,[3] this period of observation must have certain limitations. His criterion that stable circulation be established with 1,500 cc. of blood in twenty-four hours is an excellent one. Stewart[4] has used the actual amount of hemorrhage as the principal factor in his decision for emergency surgery. Patients with blood volumes below 60 per cent are operated upon immediately, with massive blood replacement. Whether this method of management will prove superior to the method of letting the patient prove the need remains to be determined. It certainly will prevent death from hemorrhage, but emergency gastrectomies will be performed upon many patients who would have responded to medical management.

Whether or not a peptic ulcer will stop bleeding depends to a large degree on the pathology of the ulcer itself. We, as many others, have been impressed by the role that chronic perforation plays in those bleeding ulcers requiring emergency surgery. Heuer,[5] in an excellent analysis, showed that chronic ulcers of the posterior duodenal wall and along the lesser curvature of the stomach were present in all patients requiring emergency surgery for hemorrhage and also in all of those patients in whom there was exsanguination without surgical treatment.

The pathology and anatomy of chronic perforation preclude in most instances any hope of benefit by medical means. The ulceration has destroyed the entire wall of the stomach or duodenum, and either there is an extraluminal pocket of fibrous tissue or one of the other abdominal viscera, such as pancreas or liver, is adhered to and forms the base of the ulcer. Chronic perforating ulcers occurring in the duodenum characteristically have their base formed by the head of the pancreas. The gastroduodenal artery and its branches are so situated that necrotizing arteritis occurs, with dissolution of the anterior wall of one of these large vessels. Recurrent exsanguinating hemorrhages result. (Fig. 1.) Similar pathologic lesions occur

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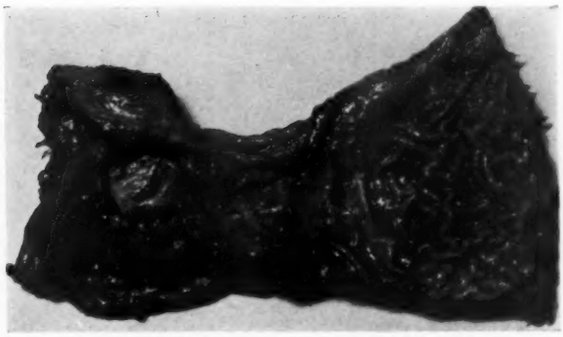

FIG. 1. Postmortem specimen; medical death from ulcer hemorrhage. Chronic perforating duodenal ulcer, its base formed by the head of the pancreas. Note slit aperture in major branch of gastroduodenal artery in upper right hand portion of ulcer.

in the stomach, particularly along the lesser curvature. Lesions in this area erode large branches of the left gastric artery. (Fig. 2.) When one visualizes these lesions, it is difficult to imagine any therapy other than direct surgical attack being of benefit. Alkalies, dietary measures and so forth cannot replace gastric or duodenal wall or heal apertures in large vessels.

The following fifty-seven cases of massive hemorrhage, the result of benign peptic ulceration, were analyzed in some detail. These cases were chosen from a survey of patients admitted during the last seven years at Temple University Hospital. We believe that incorrect statistics are obtained when mild, moderate and massive cases of ulcer and hemorrhage are grouped together and compared as to medical and surgical mortality. It is fallacious indeed to group together patients who have lost 200 cc. from bleeding peptic ulcers with those who have lost 2,000 cc. They have in most instances an entirely different ulcer pathologically, and their therapeutic problem, both medical and surgical, is in no way similar. All of these fifty-seven cases satisfy the following criteria for massive hemorrhage.

In every instance these individuals exhibited hemorrhagic shock. In addition one of the following criteria was also present. (1) Hemoglobin was 8.5 gm. or below. (2) The red blood count was below 3,000,000. (3) Hematocrit was 30 or below.

Of these fifty-seven patients sixteen were operated upon as emergency procedures because of recurrent or continued bleeding under medical treatment. This was usually done during the first forty-eight hours of hospitalization. No case was included in which operation was an

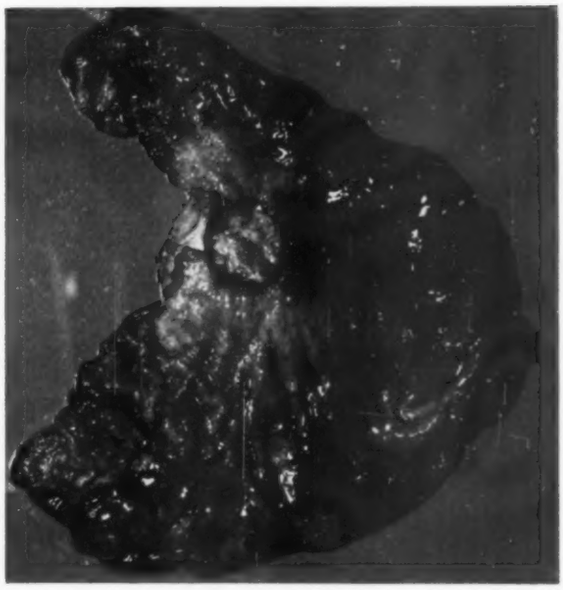

FIG. 2. Surgical specimen of chronic perforating ulcer along lesser curvature of stomach. Note open ends of large branches of the left gastric artery in base of ulcer.

elective procedure because of a previous bleeding episode. The etiology of the hemorrhage was proved to be peptic ulceration in all of the patients treated medically by means of x-ray or gastroscopy, and in the surgical cases the ulcer was visualized. Medical treatment consisted of adequate blood replacement controlled by daily blood counts and hematocrits in addition to small frequent feedings, alkali or buffer, sedation and reassurance. Although the factor of age played a part in deciding on emergency surgical treatment (Table 1), the persistence or recurrence of massive hemorrhage after adequate blood replacement and medical therapy was considered the most important factor in the decision for operation. Fifteen of the pa-

TABLE 1
AGE DISTRIBUTION OF PATIENTS WITH MASSIVE PEPTIC ULCER HEMORRHAGE

Age (yr.)	Medical Cases	Surgical Cases
10–19	1	
20–29	2	3
30–39	5	3
40–49	12	4
50–59	9	4
60–69	8	3
70–79	3	
80–90	1	

tients operated upon had partial gastrectomy of the Hofmeister or Pólya type. The exclusion type of procedure was not done in any of the duodenal ulcers. One of the patients operated upon had local excision of a high gastric ulcer combined with vagotomy and gastroenterostomy. All surgical patients had massive blood replacement during surgery and the majority were done under endotracheal anesthesia.

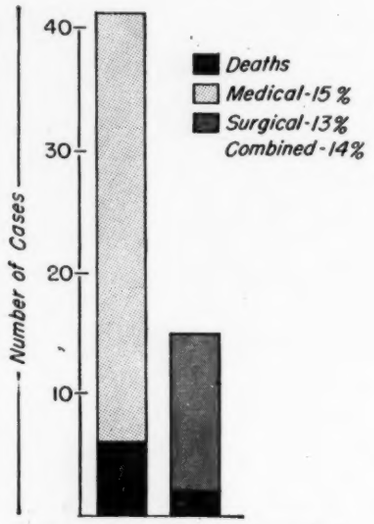

FIG. 3. Medical and surgical cases, and mortality percentage in each.

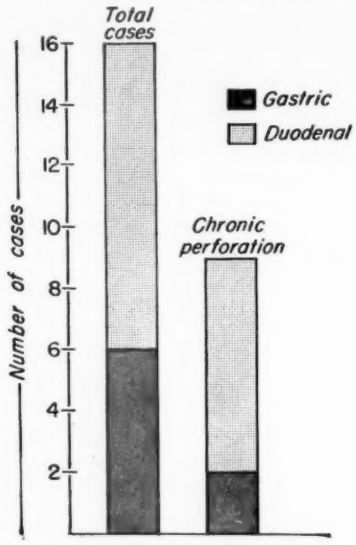

FIG. 4. Incidence of chronic perforation in patients requiring emergency surgery during active bleeding.

Comparative mortality statistics, which have little value in such a study, show a medical mortality of 15 per cent and surgical of 13 per cent, with a combined mortality of 14 per cent. (Fig. 3.) Of two surgical deaths, one was due to definite error in technic with death due to a leaking duodenal stump and peritonitis. The second surgical death was the result of a heroic attempt to salvage a patient who had had recurrent exsanguinating hemorrhages for two weeks and who was operated upon after massive blood replacement. This patient had cardiac arrest on the operating table and was massaged. Return of heart beat occurred but he died within twenty-four hours. Autopsy revealed marked degenerative changes of all organs secondary to the repeated episodes of anoxia. In addition a chronic subdural hematoma was present. In the sixteen surgical cases the ulcer responsible for the bleeding was gastric in location in six and duodenal in ten. Chronic perforation was present in two of the six gastric lesions and in seven of the ten duodenal lesions, a total incidence of chronic perforation in nine cases of sixteen. (Fig. 4.)

There were six medical deaths, that is patients who died of ulcer hemorrhage without surgical treatment. Two of this group refused surgery despite urgent pleas of the physicians in charge. One death occurred following large bowel surgery complicated by peritonitis in an elderly man and was considered to be beyond control by either surgical or medical means. Three deaths occurred under medical therapy. All of these patients who died without surgical treatment were examined postmortem, and three of the five operable cases showed chronic perforation of a duodenal ulcer with hemorrhage from the gastroduodenal artery while one showed chronic perforation of a gastric ulcer with erosion of a large branch of the left gastric artery. (Figs. 5 and 6.) Had these five medical patients who were salvable been managed by adequate blood replacement followed by surgical treatment because of their recurrent or continued bleeding, the over-all mortality of massive peptic ulcer hemorrhage would have been considerably improved. If only three of these five patients had survived surgery, the combined mortality rate of this series would have dropped from 14 to 8 per cent. It is important to emphasize that five of the six cases of death from ulcer hemorrhage in the medical group were patients with surgically amenable lesions.

It would be most desirable to know which

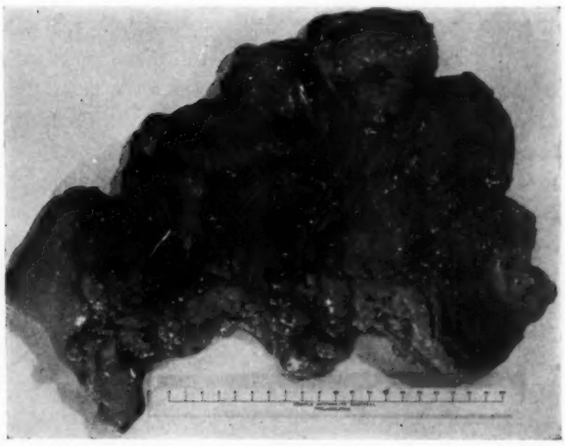

FIG. 5. Postmortem specimen; medical death from ulcer hemorrhage. Chronic perforating duodenal ulcer. The probe to the right is in the gastroduodenal artery and the one on the left is in the papilla of Vater.

FIG. 6. Postmortem specimen; medical death from ulcer hemorrhage. Chronic perforating gastric ulcer along lesser curvature of stomach with major branch of eroded left gastric artery visible.

case of bleeding has chronic perforation of an ulcer as its background. This is difficult to establish. History of pain of a constant nature preceding the hemorrhage is highly suggestive of a chronic perforating ulcer. Constant pain and massive hemorrhage have been stated to be an ominous combination[6] and we believe this is because the ulcer responsible in such circumstances is usually a chronic perforating one and is likely to cause recurrent massive bleeding. In this small series there were thirteen proved chronic perforating ulcers, and seven of these patients complained of a constant type of epigastric pain or boring constant back pain for periods of two days to two weeks preceding the onset of their bleeding. This constant type of pain was noted in only two of the thirty-five patients who were successfully treated medically. It is also interesting that of the thirteen proved cases of chronic perforation ten had a history of either past manifest hemorrhage or previous acute perforation. In the nine patients with chronic perforation in the surgical group three had a history of manifest hemorrhage in the past and four others had a history of acute perforation. (Fig. 7.) In the medical group of patients who died there were four with chronic perforating ulcers. Two of these had a history of past manifest hemorrhage and one a history of past acute perforation. Comparing these incidences of hemorrhage and perforation with the medical cases treated successfully, one finds that only three of the thirty-five patients treated successfully had a history of past manifest bleeding and none had a history of acute perforation. (Fig. 8.)

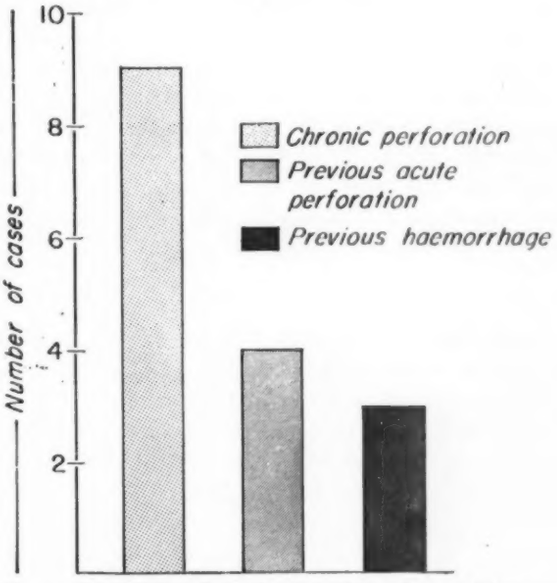

FIG. 7. Incidence of previous manifest hemorrhage or acute perforation in surgical cases showing chronic perforation.

Other factors, such as localized abdominal

tenderness, have been mentioned as indicative of chronic perforation. We do not find this to be true in this particular group of patients and believe that it was due principally to the fact that these ulcers were well walled off and were adherent deep in the abdomen to retroperitoneal structures. X-ray examination is hampered by the fact that these patients have recently bled and are unable to go through a standard gastrointestinal series. It is also true that chronic perforation does not always give a characteristic x-ray appearance unless there is an extraluminal pocket. Gastroscopy is of little value in view of the acute hemorrhage and also in the inability to visualize the duodenum. Other factors, such as the duration of symptoms and the degree of the initial hemorrhage, were not reliable in determining the pathologic state of the ulcer in this series of cases.

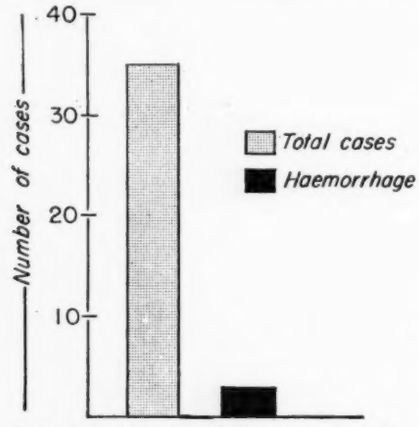

FIG. 8. Incidence of previous manifest hemorrhage or acute perforation in patients with massive peptic ulcer hemorrhage not requiring surgery.

CONCLUSION

Chronic perforation of a peptic ulcer with massive hemorrhage is pathologically and anatomically unsuited for medical therapy.

In this series chronic perforation played an important role in medically intractable, massive peptic ulcer hemorrhage.

SUMMARY

Fifty-seven cases of proved massive peptic ulcer hemorrhage have been reviewed. Generally they were managed by early, adequate blood replacement and dietary and alkali therapy. If manifest bleeding continued or recurred, they were considered surgical emergencies. Sixteen patients of this group of fifty-seven required emergency surgery and fifteen required partial gastrectomy with direct surgical control of the bleeding. In one patient with a high erosive lesion of the stomach ligation excision of the ulcer was done combined with vagotomy and gastroenterostomy.

Two of these sixteen patients died as a result of their surgery. Nine of them had chronic perforating ulcers as the source of their hemorrhage, the ulcers being located either on the posterior duodenal wall or along the lesser curvature of the stomach. Of the six non-surgical deaths reported five had surgically amenable lesions. Four of these five lesions were chronic perforations. Ten of thirteen patients with chronic perforation had a history of either past manifest hemorrhage or past acute perforation. Seven of thirteen patients with chronic perforation had a history of a constant type of pain preceding their hemorrhage.

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BENIGN ULCER OF THE SMALL BOWEL*

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BENIGN non-specific ulcer of the small bowel is rare.[1–3] It is very easy to overlook on the operating table, is dangerous to life and as yet, as an isolated case, is not sufficiently striking to be sure of further emphasis.

Most recorded accounts of lesions akin to this infrequently encountered entity concern themselves with jejunal ulcer secondary to gastroenterostomy, the ulcer arising in Meckel's diverticulum, ulcers associated with regional enteritis and other specific causes.[4] In this survey these cases have been omitted.

During a period of fifteen years, from July 1, 1936, to July 1, 1951, admissions to Charity Hospital and Touro Infirmary numbered 1,035,993, during which time there were seven individuals presenting benign non-specific ulcers of the small bowel. This report sets down the plight, as indeed it was, of these seven in detail and includes a discussion pertinent to the problem.

In spite of the extremely active proteolysis which occurs in the upper part of the small intestine during digestion, the region of the bowel from the papilla of Vater to the lower ileum is in normal conditions singularly free from lesions arising in the wall of the intestinal tube.[2] Such lesions as congenital anomalies,[5] enteritis, obstruction from adhesions, primary carcinoma,[6] sarcoma, benign tumors, polypi, diverticula, ulcerations in systemic diseases and ulcer following gastrojejunostomy occur with some degree of underlying specificity.

True peptic ulcer does occur occasionally in Meckel's diverticulum and in the esophagus where dystopic rests of gastric mucosa and evidence of secretion of acid have been demonstrated.[7] Tissue similar to acid-bearing gastric mucosa has also been observed in the intestines by Nicholson.[8] The thought in their minds is that some element exists in the mucosa which lends itself to disturbances which promote necrosis and ulceration. Being located in a foreign field, these glands are more subject to adverse influences by reason of the unusual environment.[9]

Tryptic digestion under certain conditions may become the principal cause of chronic primary ulcer of the small bowel. It may be that infection[10] from distant foci, lues, tuberculosis, vasomotor phenomena and precedent enteritis may play a part. Implicated by some in the causal relationship are ischemia, sympathetic nervous system lesions, sepsis and trauma.[11] Non-specific granuloma as a variant of regional enteritis must be considered in most of the cases in this and other reports.

FIG. 1. Grossly, acute ulcer.

The pathologic picture resembles that of ulcer of the stomach or duodenum. Grossly, the ulcer (Fig. 1) is a circular lesion varying from 4 mm. to 4½ cm. in diameter. Only 15 per cent are annular. Thickening, induration, stenosis and chronicity are prominent. Most occur opposite the mesenteric attachment. The majority are single and many are perforated. On microscopic examination there are changes of chronic (Fig. 2) and occasionally acute inflammation. (Fig. 3.)

Most of the patients have postprandial cramping pains greatly similar to peptic ulcer, the level of the localization varying slightly with the area of involved bowel, and have usually had difficulty for a considerable period of

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FIG. 2. Microscopically, chronic ulcer.

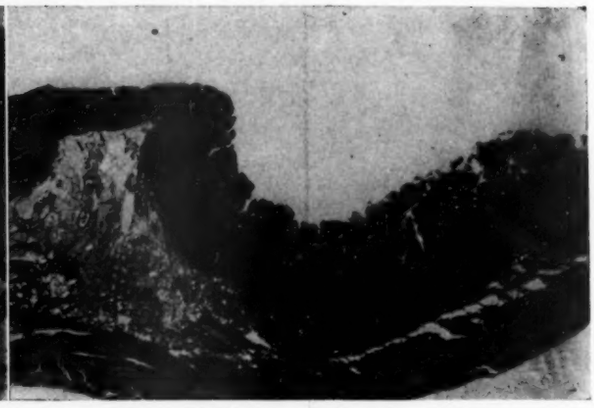

FIG. 3. Microscopically, acute ulcer.

time antedating their admission to the hospital. There may be radiation of pain to the back and, more commonly, to the left. Vomiting is not a common feature unless there is perforation or obstruction. Tarry stools and weight loss are present in a small percentage of patients. There may or may not be tenderness over the site of the lesion.

At the onset of perforation a most agonizing and unendurable abdominal pain occurs which is generalized although as a rule most marked in the area of perforation and vomiting. There are rigidity and tenderness but even here some difference in the various parts of the abdomen can be felt and the local increase affords a definite help in the diagnosis of the lesion.

Diagnosis is possible in an uncomplicated ulcer if there is sufficient suspicion to indicate delineation of the small bowel.[12] A niche on the mesenteric border of the jejunum with stasis proximal to the lesion can be demonstrated by the fractional method of studying the small bowel.[13] Duodenal ileus should lead one to think of small bowel ulcer.[14]

Once perforation has taken place, on roentgenographic examination free air, distention of the entire gut and occasionally thickening of the walls are seen; and between intervals of bowel there may be opacity suggestive of fluid.

In considering therapy for uncomplicated chronic ulcer I think that the proper course to follow is resection of the segment well away from any involvement—a point to be emphasized. Aside from the obviously urgent aspect of surgical intervention in the perforated ulcer, this poses more of a problem. A certain leeway exists depending on the findings at the time of surgery as to the choice: resection of the ulcer, closure without resection using purse-string or Lembert's sutures, biopsy with closure of ulcer, resection of a portion of small bowel and, rarely, excision of ulcer and then enteroenterostomy.[15] Omentum may be used to reinforce the suture line.[16] Resection of the ulcer and surrounding small bowel is probably the procedure of choice.[17] Encroachment on the lumen which is a real danger with a less radical approach is ordinarily obviated with adequate resection.

CASE REPORTS

CASE 1. E. G., a sixteen year old colored female, was admitted to the hospital on December 25, 1938, with a chief complaint of lower abdominal pain. This dated back five months. The pain was intermittent, cramping and more severe after meals. She also had pain in the lumbar region. Bowel movements had been normal. She had marked loss of weight and weakness which had been progressive for the past month prior to admission. She had been on an ulcer program for the last three weeks before admission to the hospital. Her menses had started at the age of fourteen years and were regular until onset of the present illness when she ceased menstruating. She had had frequent headaches. Past history revealed that she had had malaria four years before admission. Her mother had died in an asylum.

On physical examination the patient was poorly nourished and poorly developed. There was a systolic apical murmur. Blood pressure was 160/100. There were masses in both adnexae and lower abdominal tenderness. A tarry stool was found on rectal examination.

The rather far advanced debilitated status was borne out by the hematologic examination: hemoglobin 25 per cent, red blood cells 1.6 million, white blood cells 19,700, neutrophils

88 per cent, lymphocytes 5 per cent, monocytes 3 per cent, eosinophils 1 per cent. Urinalysis was as follows: specific gravity 1.012, trace of albumin, no sugar or formed elements. Wassermann test was negative. Urea was 11.2 mg. per cent. Glucose was 105 mg. per cent. Phenolsulfonphthalein was 45 per cent total in two hours. The stool was positive for blood. Chest film three days after admission was clear.

The patient was put on a high caloric, high vitamin diet with aminophyllin, luminal, iron, liver and blood. She continued to vomit, became more lethargic and blood pressure increased to 170/120. The administration of blood in large quantities failed to change the course. She continued to complain of cramping abdominal pain and vomiting and died on December 31st. Temperature daily during admission was 101–104°F. Pulse rate was 100 to 140 per minute. Autopsy diagnosis was ulcer of the ileum with perforation, acute peritonitis and chronic glomerulonephritis.

Case 11. (Reported elsewhere.[18]) J. I., a white male aged nineteen, was admitted November 23, 1939, with an acute condition within the abdomen of four days' duration. Five months previously he had had attacks of colicky pain in the left inguinal region and mild postprandial discomfort in the upper part of the abdomen. An ambulatory ulcer regimen gave no relief. In a three-month interval he had lost 25 pounds. Two months prior to admission he experienced a three-day period of diarrhea, profound weakness, umbilical pain and cherry-red stools. This time his physician ordered bed rest for treatment of the "ulcer." From this time on he suffered almost constant pain in the left lower quadrant and had repeated episodes of emesis.

Four days before admission a sudden severe pain developed in the left mid-section of the abdomen which radiated to become periumbilical and later localized in the appendiceal area. There were associated emesis, a sharp febrile rise and loose stools with progressive abdominal distention.

When examined the patient was acutely ill and febrile. The abdomen was distended symmetrically. There was acute tenderness in the right lower quadrant with poorly localized marked rigidity. One gained the impression of a thick, edematous parietal peritoneum. No mass could be felt.

The leukocyte count was 22,000 with 93 per cent neutrophils. Films of the abdomen taken in the supine and upright positions were negative. On the basis of these observations the diagnosis was made of a perforated hollow viscus, probably Meckel's diverticulum or appendix. The surgical consultant thought that the duration of the symptoms might well fit abdominal tuberculosis or Hodgkin's disease and advocated further observation.

The patient was treated conservatively with transfusions, Wangensteen suction, parenteral fluids, vitamins and alcohol. The Wassermann reaction, tests for agglutination and blood and stool cultures were repeatedly negative. There were twenty-one units of free hydrochloric acid on gastric analysis. The patient's condition became progressively worse with inanition and hypoproteinemia (serum proteins totaled 4.25 gm. per 100 cc.). Later he exhibited definite adynamic ileus despite from five to seven watery stools daily. That he had a ruptured viscus was confirmed by x-ray examination, free air and fluid being present intraperitoneally.

Exploratory celiotomy disclosed a perforated jejunal ulcer 24 inches beyond the ligament of Treitz. This was plicated. On the second postoperative day pulmonary and renal infarcts developed and the patient died.

At necropsy, in addition to generalized peritonitis, pulmonary and renal infarcts and the sutured jejunal ulcer there was another perforated jejunal ulcer 3 inches beyond the ligament of Treitz which was oblong and measured 2 by 1 cm. On microscopic sections of the two ulcers there were chronic inflammatory changes comparable to a benign peptic ulcer.

Case 111. J. L., a twenty-six year old white man, was admitted to the hospital January 27, 1942, with a four-day history of severe pain across his lower abdomen which started out rather suddenly. This had persisted but was not accompanied with vomiting. He later saw a doctor who gave him two doses of morphine and this helped to ease him. However, some twelve hours after onset of pain he started vomiting and had not eaten for a four-day period until his admission. His abdominal pain had not been crampy or colicky but persisted continuously and throughout his entire abdomen. His bowel movements ceased with the onset of present illness. Two weeks before the onset of the present illness he started having vague abdominal pains and had lost about 15 pounds during this two-week period. When in

the past he had drunk a good bit of whiskey, he had vomited afterward and had occasionally noticed some flecks of blood in his vomitus. Past history revealed the patient had undergone appendectomy in 1935 and had had jaundice in 1938.

Physical examination revealed blood pressure 135/90. The patient was a well developed, well nourished white man vomiting almost continuously and acutely ill. His teeth were carious. There was generalized tenderness over the abdomen as well as faint peristalsis but no rectal tenderness.

There was mild variation in the hemogram: 90 per cent hemoglobin, 5.9 million red blood cells, 17,000 white blood cells, 80 per cent neutrophils, 20 per cent lymphocytes. Sedimentation rate was 18 mm. per hour. Urine was acid, specific gravity 1.016, two plus albumin, no sugar or formed elements. Urea was 48.4 mg. per cent, CO_2 42 volumes per cent and chlorides 444.6 mg. per cent. Kline and Kolmer tests were negative. Demonstrable on roentgenograms was free air under the diaphragm.

The patient was taken to surgery and under spinal analgesia abdominal exploration was carried out. There was a moderate amount of cloudy fluid which cultured Escherichia Clostridium welchii. There was an inflammatory process in the right lower quadrant. The ileum was normal except for a short distance proximal to the ileocecal junction where there was a perforation. A biopsy was taken from the ulcer. The ulcer was closed with two layers of catgut, and 10 gm. of sulfathiazole powder were placed in the peritoneal cavity. The patient died four and a half hours later. Death note stated that after operation his condition was poor and several hours later he went into shock, became clogged with mucus in his trachea and could not be rallied.

The microscopic diagnoses were chronic ulcer of the ileum with perforation and peritonitis. Etiology was not demonstrable by histologic examination.

Case IV. S. L., a thirty-six year old colored man, had been hospitalized many times. The first admission for his abdominal complaints was on November 19, 1941, when the patient was admitted to the hospital with abdominal pain and burning, nausea, vomiting and diarrhea which had developed two weeks prior to admission. The vomiting was often coffee colored and on several occasions the patient had passed black tarry stools. Marked tenderness was present in the right upper quadrant just above and to the right of the umbilicus with pain also in the right lumbar region. Clinical impression at that time was duodenal ulcer with hemorrhage and possible perforation.

Past history revealed the patient had been in the hospital intermittently for the past year with pain and swelling of the right ankle and a strongly positive blood Wassermann test. It was believed at the time that the patient had luetic involvement of his right ankle for which he was treated systemically and encasement of the extremity in a short leg plaster cast.

The laboratory data on this admission were essentially normal with the exception of strongly positive Kline and Kolmer tests. Stool disclosed blood and giardia lamblia cysts. All agglutinations were within normal range. In the spinal fluid less than 10 cells per cu. mm. were found and globulin was one plus: Kline and Kolmer tests were negative. A gastrointestinal series questioned the presence of a duodenal ulcer. However, this was repeated and no ulcer could be demonstrated. A barium enema showed some spasm of the distal end of the transverse colon. On the Graham-Cole dye excretion examination the gallbladder was visualized but emptied poorly. The patient remained in the hospital for more than two months with the diagnosis still undetermined. He was still complaining of abdominal pain and vomiting when he deserted from the hospital. The last admission to the hospital was on April 18, 1942, at which time the patient was continuing to have abdominal pain. He had lost 15 pounds in weight in the last month and had noticed swelling of the left leg which had started four days previously. He had a productive cough but no hemoptysis. He had frequent night sweats.

On physical examination he was a well developed, emaciated, oriented, weak Negro man who appeared chronically ill. Blood pressure was 100/60, temperature 98.2°F., pulse 88 and respiration 20. The mouth was edentulous. Expansion of the lungs was limited and there were a few scattered rales in the left base. There were no areas of tenderness in the abdomen. No masses were palpable. The left leg was swollen to three times normal size, with massive pitting edema from the toes to the groin. There was pain also along the course of the deep vessels.

Laboratory data showed there were numerous pus cells in the urine. There was on examination

of the chest a hemothorax on the right with 40 per cent collapse of the lung and fluid at the base to the level of the eleventh dorsal vertebra. The cardiac shadow was displaced to the left. Sputum examinations were positive for acid-fast bacilli. CO_2 combining power was 48 volumes per cent on April 21st. Serum protein on the same date was 8.3 gm. per cent.

The patient's condition worsened in the hospital and he died four days after admission on April 22nd. Autopsy findings were solitary jejunal ulcer, residual periappendiceal abscess as a result of recent perforation of the appendix, thrombosis of the left iliac and femoral veins with edema of the left leg, thrombosis of small branch of inferior mesenteric artery, confluent bronchopneumonia of the left lower and right lower lobes, small solitary lung abscess, fibrinous pleuritis and pleural effusion. The following is a description of the abdominal findings at necropsy: "In the terminal portion of the jejunum there is a small gray ulcer measuring 0.3 cm. in diameter extending through to the serosal surface. Over this area the omentum is adherent. Around the base of the appendix there are 3 cc. of pus and thick fibrous adhesive tags encapsulating the base of the appendix."

Case v. E. P. C., a sixty-eight year old white man, was admitted to the hospital on August 20, 1947, with a chief complaint that twenty-four hours previously he had started having slight cramping pains across the middle of the abdomen. He had eaten and the pain became worse. An hour later he vomited. The pain had become progressively worse. The bowel movements had been regular.

Past history revealed that for the past ten to fifteen years he had had cramping abdominal pains which usually came on after meals and occurred two or three times per week. He was in the hospital three years previous with anemia and treated with liver shots. He had had a bilateral hernioplasty fifteen years before and was in bed three months. He had required skin grafts.

On physical examination the temperature was 101°F., pulse 100, respiration 20 and blood pressure 110/60. There was a systolic apical murmur. There were marked tenderness and rebound over the whole of the abdomen but more marked in the right lower quadrant, and slight rigidity over the lower abdomen. Peristaltic sounds were decreased. There was cul-de-sac tenderness.

Laboratory data showed 2.4 million red blood cells, 27,000 white blood cells, 93 per cent neutrophils, 1 per cent eosinophils and 6 per cent lymphocytes. Hematocrit was 45. The urine was amber color with acid reaction, specific gravity 1.026 and no albumin, sugar or formed elements. CO_2 was 41 volumes per cent. Serum protein was 6.5 gm. per cent. Urea was 17 mg. per cent and chlorides 561.6 mg. per cent. The Kline test was negative. There were fluid levels in the small bowel on roentgenograms taken in the upright position. The electrocardiogram was normal.

The patient was taken to surgery and under ethylene and ether anesthesia the abdomen was explored through a right rectus incision. There was a moderate amount of thin, serous, yellow, odorless transudate in the abdomen. Thirty centimeters from the ligament of Treitz there was a 3 mm. perforation with an area of induration of 1 cm. There was a moderate amount of plastic exudate over the jejunum and the surrounding viscera. The perforation was closed with catgut. Sulfanilamide powder was placed in the abdomen. Postoperatively a cul-de-sac abscess developed which had to be opened and also a wound dehiscence down to the peritoneum which required secondary closure. Gastric analysis with histamine while still in the hospital failed to evoke free hydrochloric acid.

He had no further complaints referable to his abdomen. He was seen in the clinic on July 27, 1950, with carcinoma of the base of the tongue.

Case vi. L. L., a fifty year old white woman, was admitted to the hospital on March 18, 1950, with the chief complaint of acute epigastric pain of twenty-four hours' duration. The pain was boring in character, extending through to the back. She had been nauseated since the onset and vomited once. She had had a past history with similar episodes over a period of two years occurring every two to three months. She had had no jaundice, tarry stools or diarrhea. She had refused surgery in the past. Past history revealed she had had a gynecologic procedure in 1948. She had fatty food intolerance and history suggestive of chronic gallbladder disease.

On physical examination there was tenderness in the epigastrium. Peristalsis was present. Laboratory data: Hemoglobin was 12.5 gm.; there were 8,500 white blood cells, 71 per cent

neutrophils, 29 per cent lymphocytes and hematocrit 38. Urine was clear, acid and no albumin, sugar or formed elements were found. Serum amylase was 120 Bodansky units. Kline and Kolmer tests were negative. On x-ray examination the gallbladder was visualized in the Graham-Cole dye excretion test but emptying was delayed. There were multiple diverticula in the duodenum and jejunum on the gastrointestinal series and residual barium was present in the diverticula on subsequent views; the small bowel series confirmed these findings. Intravenous pyelograms were normal, as were the chest films.

On April 6th under ethylene and ether general anesthesia the abdomen was explored through a right rectus incision. There were numerous diverticula on the mesenteric border of the jejunum. Twelve centimeters proximal to the ileocecal valve there was an indurated area covered with marked telangectasis about this region. The mass was hard, measured 1.5 cm. in diameter and had the external appearance of active inflammation and hypertrophy. There were no nodes in the mesentery. Eight centimeters of ileum were removed and end-to-end two-layer open anastomosis was carried out.

The pathologic report revealed there was an ulcer measuring 2.5 cm. in its greatest diameter on the mucosal surface of the ileum. Diagnosis was chronic non-specific ulcer of the ileum.

The patient's hospital course was uneventful and she was discharged. She was readmitted on September 13, 1951, with abdominal pain and fever. There was mild tenderness in the right lower quadrant. She was observed for twenty-four hours and the pain disappeared. She was discharged and she has had no further trouble since that time.

Case VII. E. V. M., a thirty-three year old white man, was admitted to the hospital on May 16, 1951. Four days prior to admission cramping abdominal pain developed which at its onset was in the epigastrium and later was most marked in his lower abdomen. It occurred at hourly intervals during which time he was unable to get relief from the pain. He had loss of appetite but no nausea or vomiting. Stools had been normal.

On physical examination the pulse was 88, blood pressure 125/85 and temperature 99.6°F. There was some tenderness in the epigastrium, more marked in the right lower quadrant, and very mild rebound tenderness in the right lower quadrant. There were 14,500 white blood cells with 76 per cent neutrophils. The tentative diagnosis was acute appendicitis or mesenteric adenitis.

The patient was taken to surgery the afternoon of admission and under pontocaine spinal analgesia the abdomen was opened through a McBurney incision. The appendix was normal. Twelve centimeters from the ileocecal valve there was an ulcer in the ileum. The ileum was resected and an end-to-end anastomosis carried out between the middle and terminal ileum. The portion of the ileum was 14 cm. in length. There was in this specimen a longitudinal oval punched out ulcer measuring 4½ cm. in its greatest dimension. This ulcer had a grayish brown to black necrotic base and rolled undermined edges. It was located on the mesenteric border. The serosal surface deep to the ulcer was reddish purple to black and there was extensive hemorrhage into the wall. There was a smaller circular ulcer 1.5 cm. in greatest diameter similar to the larger ulcer.

Microscopic description was as fol'ows: "There is on sections an acute ulcer of the ileum arising from Peyer's patch. The ulcer is superficial. The base is covered by acute fibrinopurulent exudate. The underlying lymphoid tissue contains small miliary abscesses. The wall of the ileum is infiltrated by neutrophils, eosinophils and lymphocytes. The musculature is preserved and shows no evidence of infarction. The serosa is hemorrhagic and infiltrated with lymphocytes. The other ulcer shows the same type of reaction and adjacent lymph node shows nonspecific lymph-adenitis. There is no evidence of any specific type of inflammation. Diagnoses: Acute multiple ulcers (2) of the ileum."

Postoperatively the patient was sensitive to penicillin but otherwise his convalescence was uneventful. Agglutination reactions taken during his reaction were within normal limits, including the typhus, paratyphus and undulant fever groups. Since that time he has had no further difficulties.

COMMENTS

The lethal complication of perforation (75 per cent mortality) in these lesions is in part due to the fact that they occurred in the era prior to the widespread use of antimicrobial agents. A much more aggressive action in sur-

gery today toward peritonitis is predicated to some degree at least on the efficacy of the therapeutic armamentarium which is at hand to employ in these cases. That one case (Case I) went undiagnosed until death and the operator in another instance (Case II) failed to recognize a second perforated ulcer in the jejunum are lessons to be remembered. However, in Case II the patient was moribund and had been observed in the hospital for several weeks with the diagnosis of a ruptured viscus and had been treated conservatively with the hope that he would wall off his inflammatory process. Certainly today his chances of survival would have been immeasurably better with a positive program of early surgical intervention, adequate coverage with the antibacterial drugs and proper fluid and electrolyte replacement.

While the death in Case III is directly attributable to the tardiness with which the patient sought medical attention, his history relating a four-day perforation in the lower ileum, it is true that he withstood the procedure of celiotomy well, later becoming clogged with material in his trachea and died. Maintenance of a clean tracheobronchial tree by frequent aspirations and a decompressed gastrointestinal tract by continuous suction is essential in the care of patients with peritonitis. These, among other things, are more easily accomplished with a recovery room and the outgrowth of the recovery room indicates a greater appreciation of the very careful attention that must be paid these patients. This close postoperative supervision would have stood the patient (Case III) in good stead.

SUMMARY

Primary ulceration of the small bowel is relatively rare in contrast with other gastrointestinal lesions. However, this lesion should be kept in mind in patients who have obscure abdominal complaints or who present signs of an acute condition within the abdomen. Seven cases are reviewed.

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USE OF TANTALUM MESH IN THE REPAIR OF HERNIAS*

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KOONTZ[1] and Throckmorton[2] have reported in detail on the clinical and experimental aspects of the use of tantalum mesh in the repair of hernias complicated by tissue deficiency. The use of foreign material, such as metallic filigrees, grids, plates and mesh, has been resorted to in the past to overcome the difficulties presented by large tissue defects. For the most part these practices have been given up. The availability of a material in the form of tantalum mesh which is strong, pliable and biologically inert, and which forms a scaffolding for the ingrowth of sturdy, white, fibrous tissue for the firm closure of hernial defects, has stimulated interest in its use as a suitable material for hernia repair when the patient's own tissues are inadequate or unsuitable for the bridging of tissue defects.

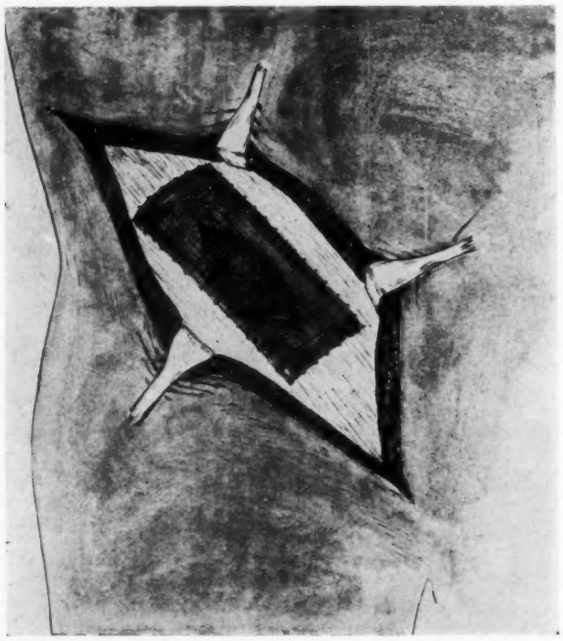


FIG. 1. Drawing illustrating tantalum mesh repair of ventral hernia.

Koontz and Kimberley[3] in a recent paper have reported further on experimental studies of the tissue reactions to tantalum mesh and wire. Their findings indicate that there is a marked fibrous reaction around and through tantalum mesh implanted in body tissues and that this is a normal fibroblastic reaction which produces soft pliable wound repair. Furthermore, tantalum mesh can be placed next to bowel in closing experimentally produced abdominal defects without causing trouble other than a few mild adhesions. They also found tantalum mesh resistant to infection so that good healing could be obtained after its implantation in spite of gross infection.

The excellent descriptions by Throckmorton and by Koontz of methods and results in the use of tantalum mesh prompted its first use at this hospital in two cases. The successful outcome in both, particularly in one (Case 1) which presented a formidable problem of repair, lead to further use of the method in other cases of hernia that were too large for the conventional repair utilizing the patient's own tissues, or presented difficult problems of closure because of tissue deficiencies.

The procedure as described by Throckmorton is a simple one to perform. A piece of tantalum gauze is cut large enough to cover not only the hernial defect but also a sufficient surrounding area to provide a secure attachment for its borders to strong fascial supporting structures. The margins of the patch are folded under for about 1 cm. in order to provide a smooth edge and a double thickness for holding the sutures. The suture material is a tantalum wire, monofilament preferably, but there is no reason why other non-absorbable suture material, such as silk or cotton, cannot be used. The sutures are placed so as to fasten the borders of the tantalum mesh patch onto strong supporting structures, either white fascia or periosteum. The patch must be large enough to be sutured in place without tension. The sutures are applied interruptedly, tied with a square knot and cut close to the knot. Figure 1 illustrates the appearance of such a tantalum

* From the General Surgical Service of the Veterans Administration Center, Biloxi, Miss. Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are a result of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

gauze patch applied for the repair of a ventral hernia.

Since August 6, 1948, a total of ten hernia repairs with use of tantalum mesh have been accomplished by several members of the surgical staff; of these eight were done for ventral postoperative incisional hernias and two for recurrent inguinal hernias. Several of the ventral hernias were of very large dimension; others, although not so large, presented problems of closure because of repeated recurrences and faulty tissues. In two cases the patch of tantalum mesh was placed over defects of fascia which could not be closed by approximation of their borders. In the remainder some preliminary approximation of tissue layers was accomplished, but obviously inadequately, so that a tantalum mesh patch was applied to reinforce the insecure closure.

Wound healing occurred in all the cases without infection. In several it was necessary to make a number of aspirations to remove subcutaneous collections of serosanguineous fluid.

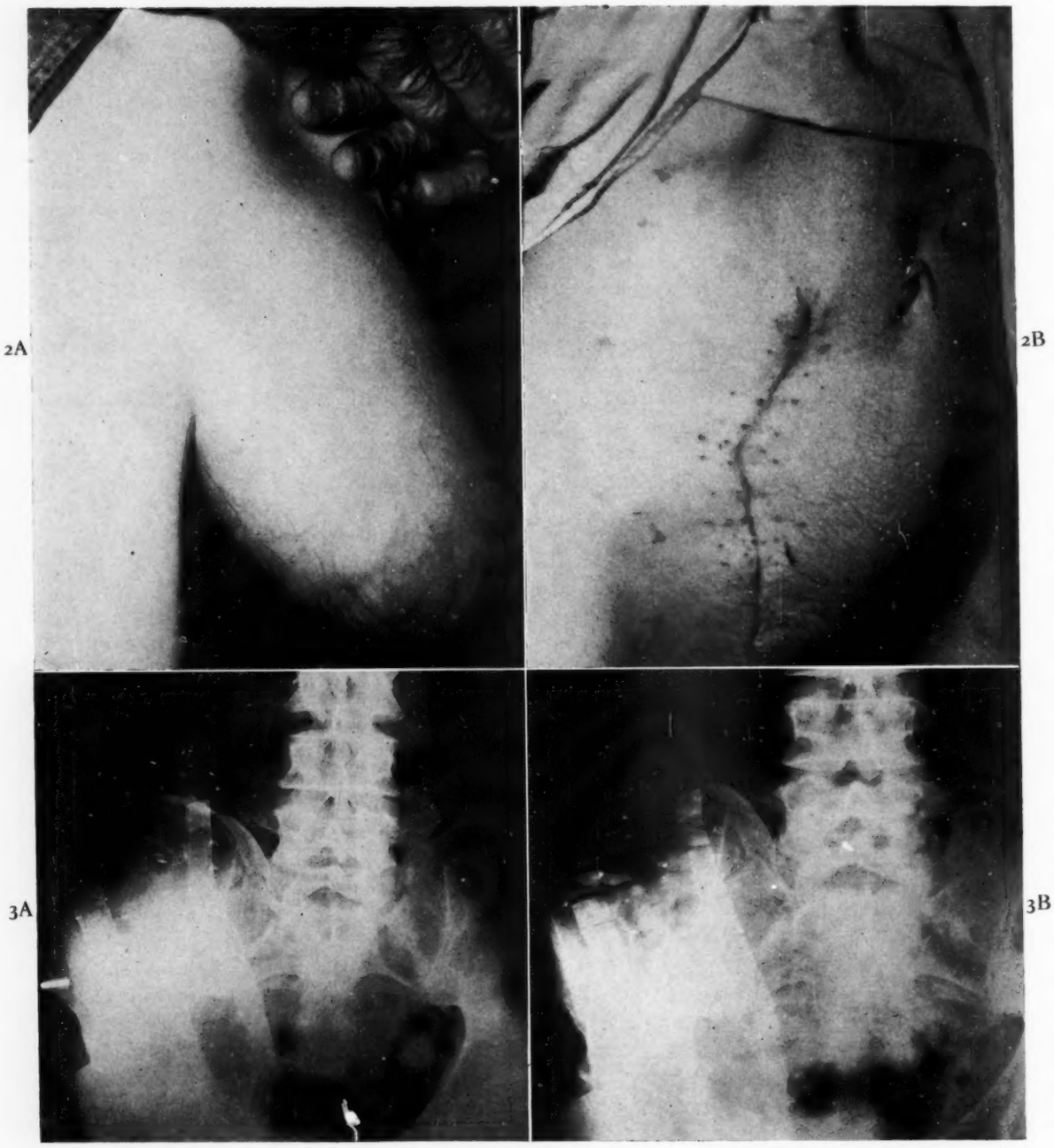
Follow-up examination has been carried out on all ten patients, the oldest over a period of twenty-four months and the most recent at the end of four months. Since the cases varied considerably in degree of tissue deficiency and strength, it is difficult to judge the results by a fixed standard for the ten cases. Seven have had unequivocally excellent results. One of these, a ventral hernia repair, deserves special mention and is reported as Case I.

CASE REPORTS

Case I. This was the first case in which tantalum mesh was used. (Figs. 2 and 3.) H. J. S., a fifty-nine year old man, showed a large sleeve-like hernial protrusion through a fascial defect in the right lower quadrant of his abdomen at the site of a McBurney scar. This protrusion measured about 9 inches in length and prevented the proper fitting of a prosthesis for his right thigh amputation stump, the result of a railroad accident in 1938. The patient was first seen at the Veterans Administration Hospital in Gulfport, Mississippi (neuropsychiatric), where he had been a patient for some time. He was transferred to the Biloxi Veterans Administration Hospital for operation. This was performed on August 16, 1948. The fascial defect could not be obliterated by layer closure. A patch of tantalum mesh was applied to cover the defect. The repair involved the shaping of the tantalum patch so that it included the weakened inguinal region, and this required the fitting of it around the cord as it emerged from the internal ring. Follow-up examination two years after operation showed no recurrence of the ventral hernia. A slight bulge was apparent at the site of the emergence of the cord. This was particularly evident because of the extreme thinness of the abdominal wall. There appeared to be almost complete absence of the subcutaneous fat layer so that the outline of the tantalum mesh patch could be visualized as though the skin were translucent and could be outlined by palpation quite easily. Careful examination failed to reveal a true inguinal hernial protrusion at the time of the last examination in August, 1950. The area remains suspect, however, and will be watched for such a possible development at later follow-up examinations. The eradication of the ventral hernia has remained complete and the appearance two years after operation is the same as that shown in the early postoperative photograph. The repair of the hernia had a most favorable effect on the patient's psychotic disorder and he was returned home shortly after his transfer back to the Gulfport Veterans Administration Hospital. The personality change for the better was obvious once the hernia was repaired and a new well-fitting prosthesis obtained for his amputated right lower extremity. The follow-up visits have indicated a continuation of this psychiatric improvement.

Three cases of ventral hernia repair have shown recurrence. All three showed one common feature as a possible explanation for the recurrences—an inadequate size of tantalum mesh patch to cover the hernial defect and the surrounding weakened structures. This feature is well brought out in the reports on Cases II, III, and IV.

Case II. J. A. F., a fifty-one year old man, was admitted July 11, 1949, for repair of a thrice recurrent ventral postoperative incisional hernia following appendectomy in 1933 through a McBurney incision. Operation was performed on July 12, 1949, and this time, in addition to a partially effective layer closure, a patch of tantalum mesh about 4½ by 2 inches was applied as a supplementary layer. Convalescence from operation was uneventful. The operative wound showed good closure by pri-



2A 2B

3A 3B

FIG. 2. Case 1. Large ventral postoperative incisional hernia. A, preoperative appearance; B, postoperative appearance.

FIG. 3. Case 1. Postoperative x-ray appearance of tantalum mesh. A, early; B, late (eight months). Note the horizontal fragmentation.

mary union. Follow-up examination on September 8, 1950, showed complete absence of recurrence in the area covered by the tantalum patch in the right lower quadrant. However, there was a distinct although moderate bulge of the abdominal wall above the upper margin of the tantalum mesh patch indicating that the tantalum patch used had been too sparingly cut and shaped, and suggesting that a patch made large enough to cover a more extensive area of the weakened abdominal wall structures beyond the immediate limits of the hernial defect would have been more effective in preventing recurrence. Reoperation at a later date

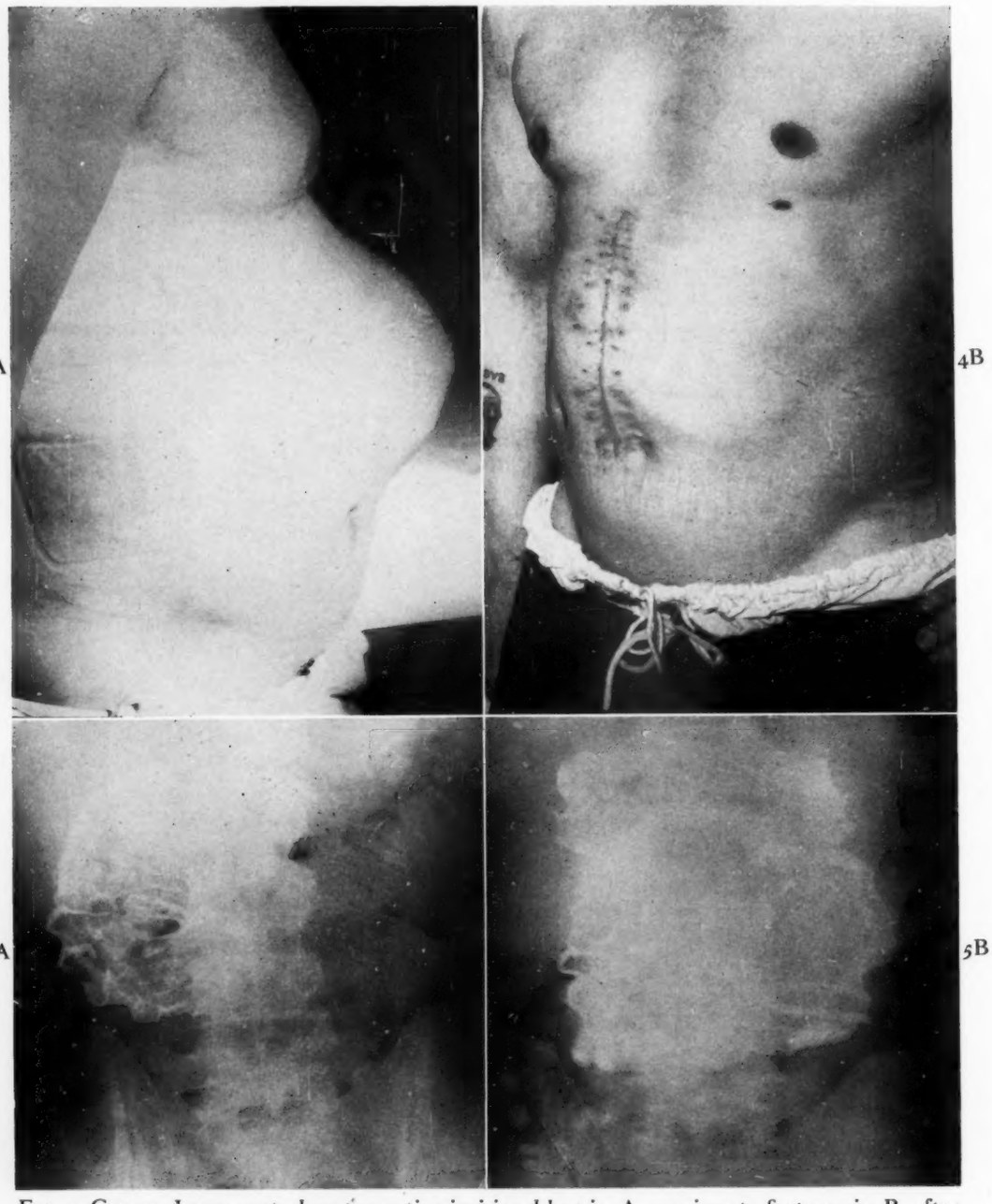
with the object of applying such a larger patch of tantalum mesh is under consideration.

CASE III. J. M. B., a fifty-five year old man, was admitted on September 6, 1949, as an emergency case. Exploratory laparotomy revealed a large perforation of a gastric ulcer on the posterior stomach wall high up on the lesser curvature. Biopsy showed no evidence of malignancy, and simple closure was effected. Postoperatively wound healing was complicated by moderate dehiscence of the skin layer, which was later secondarily closed but which required healing by secondary intention before full closure was completed. Although separation of the deeper fascial and peritoneal layers was not definitely demonstrated at the time, the discharge of serosanguineous fluid indicated that some separation of the deeper layers had occurred. The subsequent development of a ventral hernia confirmed this view. The patient was readmitted on November 30th with symptoms suggesting partial intestinal obstruction, probably due to postoperative adhesions. Relief was accomplished by intestinal intubation and suction drainage. A large epigastric, postoperative incisional hernia was quite evident at this time together with marked separation of the upper rectus muscles. Another episode of partial intestinal obstruction occurred on December 17th and this was again relieved with a Miller-Abbott tube and suction drainage. The patient was then prepared for operation. On March 23, 1950, exploration was carried out. Some peritoneal adhesions were freed and gastrotomy showed no residual lesion at the site of previous perforation. The large epigastric ventral hernia made wound closure difficult. Partial layer closure was effected and over this a sheet of tantalum mesh, measuring about 8 by 16 cm., was placed. The wound healed without complication.

Follow-up examination on August 23rd showed a slight diffuse bulge in the epigastrium. Examination on January 11, 1951, showed that the slight bulge had enlarged to a full blown recurrent ventral hernia. Wide separation of the upper rectus muscles, measuring about 8 cm. and extending from the xyphoid to the umbilicus, a length of about 15 cm., was evident. In the absence of a substantial subcutaneous fat layer it was possible to palpate the tantalum mesh patch beneath the skin. Its borders barely extended beyond the edges of the herniated area and it was obvious, in the standing position, that the tantalum mesh patch had no anchorage of sufficient strength laterally to prevent its bulging outward as it surmounted the summit of the protruding hernia. X-ray of the area confirmed the inadequacy of the size of the tantalum patch. As in Case II, it was apparent that the size of patch to be effective must extend well beyond the immediate margins of the hernial defect in order to secure anchorage on firm surrounding fascia. This patient has been in the hospital again for gastrointestinal bleeding and x-rays have shown evidence of pyloric obstruction. Abdominal exploration will in all probability have to be done and it is likely that closure of the abdominal wall will then require application of a very large piece of tantalum mesh to insure effective anchorage on firm fascia at a distance from the hernial margins.

CASE IV. A. S. C., a short, stocky thirty-six year old man, had a large ventral hernia (Fig. 4A) at the site of an upper right quadrant cholecystectomy scar, repaired with use of tantalum mesh patch on October 25, 1949, at this hospital. The repair was undertaken with much misgiving in the face of concomitant severe bronchial asthma. The asthma was partially controlled temporarily during the postoperative period by sedation and antiallergic medications. The immediate result of the hernia repair was excellent despite the trying circumstances of persistent coughing and dyspnea.

Follow-up examination on December 8, 1950, showed a well healed, longitudinal operative scar in the upper right paramedian location. In the standing position, without straining or coughing, there was slight, if any, visible protrusion in the upper abdomen. On straining or coughing, however, there was a prominent symmetric bulge in the mid-epigastrium. This appeared to be due for the most part to diastasis of the upper rectus muscles, measuring about 5 cm. in width and extending from the xyphoid to the umbilicus. An x-ray in the anteroposterior position (Fig. 5A) showed a tantalum patch occupying the right upper quadrant for the most part and extending medially to the left of the midline for only a few centimetres. Thus the bulge which protruded through the defect provided by the diastasis of the rectus muscles was only partially covered by the left lateral extent of the tantalum mesh. No bulge was present in the area of the right



4A 4B

5A 5B

FIG. 4. Case IV. Large ventral postoperative incisional hernia. A, previous to first repair; B, after repair of recurrence.

FIG. 5. Case IV. X-ray appearance of tantalum mesh. A, after first repair; B, after repair of recurrence. Note the large size required for adequate coverage of hernial defect and surrounding attenuated structures.

upper quadrant directly covered by the mesh. This diastasis of the rectus muscles was undoubtedly present at the time of the first repair but its presence was not noted in the clinical record at the time. The absence of a hernial protrusion through a defect in the area covered by the tantalum mesh patch indicated the effectiveness of the mesh in repair of the original hernial defect. However, as in Cases II and III, the impression was obtained that the tantalum mesh patch had not been cut large enough to cover the entire area of diastasis and the fascia over the left rectus muscle beyond it, and that the recurrence was due to this failure to

anchor a large enough piece well beyond the area of the hernial defect and the surrounding weakened abdominal wall structures. In view of the persistent asthma the likelihood of progressive enlargement of the bulge in the epigastrium was obvious. A second repair was decided upon and accomplished on January 8, 1951. A large piece of tantalum mesh 18 by 12 cm. was placed in the epigastrium from xyphoid to umbilicus and extending bilaterally for attachment to the firm fascia of the upper rectus muscles well beyond the limits of the hernial bulge so that on the right side it covered and went beyond the original tantalum patch. It was interesting to note at operation that the latter was firmly incorporated in a layer of sturdy, fibrous tissue, attesting to the effectiveness of the mesh at the site of its placement. The postoperative course was essentially uneventful. The wound healed by primary union. Several aspirations of subcutaneous collections of serosanguineous fluid were required. Examination four weeks postoperatively showed no bulge in the epigastrium in the standing position. (Fig. 4B.) X-ray of the abdominal wall (Fig. 5B) showed a large piece of tantalum mesh covering the previously imbedded patch and extending well over the mid-rectus on both sides. Some loosening of the tantalum wire sutures was evident and some appeared broken and displaced, indicating that the strain of persistent coughing and movement in and out of bed had disrupted their attachments. However, this had not resulted in displacement of the mesh itself. The patient was then transferred to the medical service for treatment of his asthma.

The subsequent follow-up in this case will be of particular interest in determining whether recurrence can be averted by the use of an adequate patch of tantalum mesh even in the face of continued asthmatic coughing.

The significant feature noted in Cases II, III and IV was the inadequacy of the extent of coverage by the tantalum mesh patch. Throckmorton[2] has well stated, "All sutures holding the implant in position should be placed in strong white fascia or periosteum and the dissection must expose these structures adequately. The dimensions of the implant are limited not by the size of the actual defect to be covered, but by the position of *RELIABLE supporting structure. The implant must be of such generous proportions that it can be sutured in place WITHOUT TENSION.*" Failure to adhere strictly to this dictum undoubtedly accounted for the recurrences cited, and the presentation of these recurrences is warranted if only for the purpose of emphasizing the need to make the tantalum patch large enough to secure firm anchorage on firm fascial tissues and not to limit its size to the actual defect to be covered.

Koontz[4] in a recent article reports a case of recurrence in an inguinal hernia repaired with tantalum mesh. He calls attention to the inadequate size of the patch used in the first repair as contributing to the recurrence.

The x-ray appearance of tantalum mesh, early and late, after operation is noteworthy. These are well shown in Figure 3. After the passage of months there is an increasing amount of fragmentation and some of the tantalum sutures appear separated from their original attachment to the mesh. These features need not cause alarm for the security of the repair since, as Koontz has shown, the repair after the immediate postoperative period is not due to the support offered by the mesh itself but depends rather on the fibrous tissue which builds up through and around its supporting structure.

SUMMARY AND CONCLUSION

1. A report is presented on the use of tantalum mesh in the repair of ten hernias, eight ventral and two recurrent inguinal, all of which had tissue defects of such size or tissue structures so faulty that the conventional methods of repair by layer closure, utilizing the patient's own tissues, appeared unfeasible.

2. Photographs are shown to illustrate the materials required, the technic of their use, the type of hernia operated upon, postoperative results and the x-ray appearances of the tantalum mesh in the early and late postoperative period.

3. Follow-up studies on this small series of cases have been summarized. The analysis of the recurrences has indicated the need for careful attention to the dictum of Throckmorton with regard to the size of the tantalum patch to be used in the repair so that it is not limited to the size of the actual defect to be covered but by the position of the reliable supporting structures.

4. Tantalum mesh, of adequate size and properly applied, provides a suitable and con-

venient material for the repair of large ventral and other types of hernia which present difficult problems of closure because of tissue deficiencies.

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A recent statistical study of more than 130 cases of cancer of the penis showed that in over one-half congenital phimosis was present. In the remaining cases trauma, papillomas or venereal disease were considered as predisposing factors. No mention is made of possible contact-carcinoma in instances when the marriage partner had ulcerative cancer of the cervix, uterine fundus or vagina although in all these instances free cancer cells can be found in the vaginal canal. Cancer of the penis is more common after the age of fifty and usually starts somewhere on the inner surface of the foreskin. An ulcerative and a hypertrophic type occur. In either case conservative or radical surgery plus radiotherapy are indicated. Histologically the growth is almost invariably (but not exclusively) an epithelioma. In advanced cases the whole penis, the scrotum and inguinal glands need to be excised, preferably in one mass. Results are not always satisfactory. (*Richard A. Leonardo, M.D.*)

ESOPHAGEAL RESECTIONS*

ADVANTAGES AND MANAGEMENT OF THE COMBINED ONE-STAGE LEFT ABDOMINAL AND RIGHT THORACIC APPROACH FOR RESECTION OF NEOPLASTIC LESIONS

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SINCE O'Shawa in 1933 reported the first successful resection of a neoplastic lesion at the esophagocardiac junction with restoration of intestinal continuity, interest in resections of this type has gradually become widespread. In 1938 Phemister in this country described a successful resection of a tumor in this location and since that time we have seen increasing numbers of articles written by various surgeons, both in this country and abroad, describing their personal experiences with resections of this type.[1–5]

Until an operation of this magnitude can be done with reasonable mortality and low morbidity in the major hospitals throughout the country, it will not serve its proper purpose for it is frequently not possible for patients suffering from neoplastic disease of this type and location to be transported hundreds of miles to large medical centers for surgery.

The performance of the operation for esophageal resection should probably not be limited to those men classified as thoracic surgeons. A well trained general surgeon with practical knowledge of the fundamentals of thoracic surgery fortified by an understanding of the physiologic principles involved and supported by adequate facilities may properly perform these procedures with success.

It might perhaps be useful to point out at this time some of the difficulties encountered during the course of the standard left transthoracic approach for esophageal resection. In the course of the *left* transthoracic operation an approach through the diaphragm to the abdominal viscera is necessary in order to prepare the stomach for its delivery into the chest. The diaphragm is usually sectioned from the periphery toward the hiatus, often interfering permanently with the function of the posterior two-thirds of this organ. Postoperatively, paradoxic motion on coughing is to be expected with a greater tendency toward atelectasis and pneumonitis in the left lung. These problems make for a more troublesome postoperative course and demand expert attention if the mortality and morbidity are to remain reasonable. Many of these complications can be prevented or easily managed by those who are trained thoracic surgeons. Unfortunately, highly integrated and specially managed postoperative care is not always possible in less experienced surgical services and therefore the left transpleural approach may carry a sharp tendency toward the development of pulmonary complications often without relation to the efficiency and skill of the surgery.

When using the approach wholly through the left thorax for lesions lying cephalad to the lower few inches of the esophagus, it is difficult to transect proximal to the tumor and have sufficient esophagus for a safe anastomosis with the delivered stomach. While for some surgeons the dissection of the esophagus from behind the arch may not involve more than a short increase in the time of the operation, in the hands of the relatively inexperienced operator this dissection will be attended by no mean hazard to the patient.

The experience, which comprises the background for the present discussion, was obtained by over seventy-six operations performed on patients thought to have resectable lesions of the esophagus or cardia of the stomach. Of this group, fifty-three lesions were resected. There were ten postoperative deaths. Thirty-five of the total group of seventy-six operations were performed through the combined left abdominal and right thoracic approach. Twenty-five cases were resected using this approach. The remainder of the resections were accomplished through the more conventional left trans-

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thoracic approach, either because the lesion was in the cardia of the stomach or abdominal esophagus, or because they were performed before the author adopted the present technic.

Poor Risk Patients. Patients who undergo this operation are usually in the older age groups. A successful resection has been completed upon a woman of seventy-nine years of age; the youngest patient was forty-two years of age. The majority of patients were in the sixth or seventh decade of life. Many of these people were suffering from other conditions which attend advancing years. Prostatic hypertrophy, arteriosclerotic heart disease, hypertension, diabetes, chronic vascular nephritis, emphysema and asthma are among the more common associated problems. Cardiac disease, *per se*, in the absence of decompensation has not contraindicated the performance of this type of surgery. The cardiologist, however, has usually been consulted in evaluating those patients suspected of cardiac abnormalities. We include in our survey of the patient careful studies of the renal function including a phenolsulfonphthalein test and blood urea studies.

Surgery has not been withheld from patients because of severe hypertension alone, nor from patients with proven carcinoma who also have severe renal disease; but the postoperative deaths that we have experienced, excepting those due to pulmonary embolism, have been on the whole in those two classes of patients. To date there have been ten postoperative deaths in the resected group; four from pulmonary emboli, two from uremia secondary to exacerbation of renal disease, one from overwhelming infection, one from perforation of a stercoral ulcer in the colon two and a half weeks postoperatively and two from causes unknown.

Contraindications. The involvement of the cervical nodes with carcinoma has been accepted as a contraindication for radical operation by our group. A left recurrent laryngeal nerve paralysis, however, in a patient with carcinoma of the upper third of the thoracic esophagus without cervical nodes has not been considered a contraindication to exploration, though we have not successfully resected such a case. In lesions that lie above the lower level of the sixth thoracic vertebra a bronchoscopic study of the trachea and major bronchi is of paramount importance for the tumor may be invading the posterior wall of these structures thus indicating that resection may not be feasible. On occasion patients with carcinoma of the esophagus are seen who have massive involvement of the liver. We prefer to identify the metastasis at operation rather than assume that the patient with a carcinoma of the esophagus and a nodular liver must have metastasis. The presence of a bronchoesophageal fistula, as demonstrated by barium study and suggested by the history of the patient (patients characteristically cough immediately after swallowing liquid), is considered a contraindication to surgery at this time. Except for the aforementioned group of patients explorations have been carried out after adequate preoperative preparation despite the advanced age and often poor condition of the subjects.

Selection of Cases for the Combined Left Abdominal, Right Thoracic Approach. Patients who present lesions of the cardia of the stomach which are lying principally beneath the diaphragm but may or may not extend for an inch or two into the esophagus are not candidates for this approach. This type of lesion is more adequately managed through a thoracoabdominal incision such as that outlined by Humphreys.[3] Tumors situated in these locations represent almost 50 per cent of the total number of lesions that will be met in the esophagus or cardia of the stomach and this fact removes, therefore, a large group from management by this approach. However, when a normal segment of esophagus lies distal to the lesion, even though it may be only an inch or so in length, the left abdominal, right thoracic approach outlined hereinafter is preferred. This will include lesions of the thoracic esophagus from just above the hiatus level to the apex of the chest.

Anesthesia. In general, intratracheal anesthesia is used for the entire duration of the operation. It allows better relaxation and more complete control of the patient. Ether is often employed because of its added margin of safety and because of the freedom from the relatively toxic effects of cyclopropane on the heart and liver of debilitated elderly people. Pentothol® induction is usually carried out and sometimes curare is used for the abdominal stage of the operation to increase the relaxation and afford better exposure for mobilization of the stomach and dissection of the lower mediastinum.

Preparation of the Patient. There are many excellent articles written on this subject; those of Varco[7] will give the reader an excellent background in some of the finer details of the varied

methods of improving the nutritional status of the patient.

We are accustomed to use the Varco diets No. 1 and 2, which are nicely described in his articles and to which the reader is referred. It is only the occasional patient who is so badly obstructed that a day or two of catheter lavage of the proximal esophagus with parenteral feedings will not be followed by sufficient diminution of the edema about the tumor to allow the ingestion of a fluid diet if taken in small amounts frequently and with caution. Those patients who are not able to swallow fluids, even after this trial, are subjected to a Witzel gastrostomy. The gastrostomy is used for three weeks, after which the tube is removed and the operation, as later outlined, carried out. The performance of a Witzel gastrostomy in the region 2 inches proximal to the pylorus has not been found to complicate unduly the mobilization of the stomach at a later period.

TECHNIC OF RESECTION AND MANAGEMENT OF SPECIAL PROBLEMS

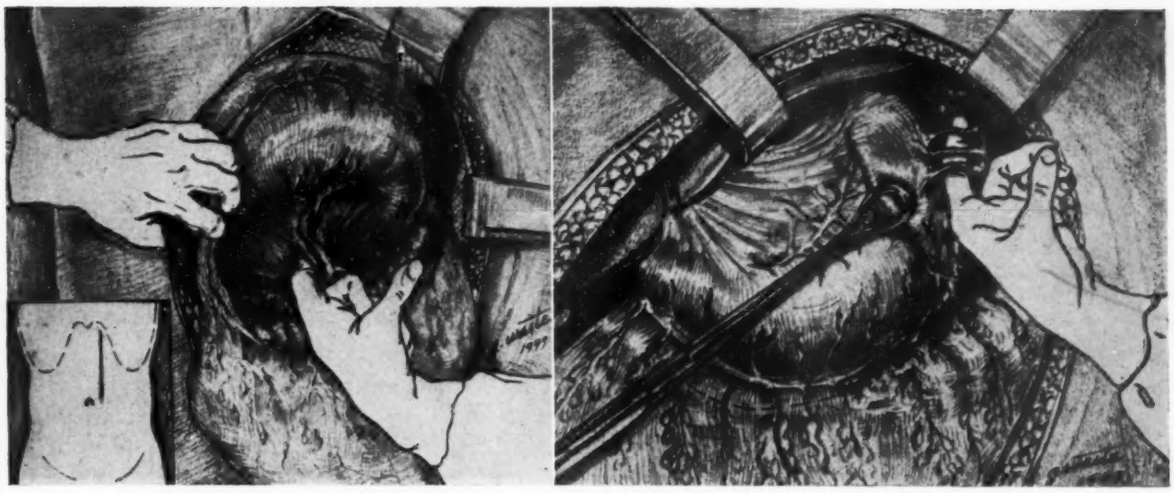
At the time of surgery a duodenal tube is passed into the proximal esophagus and secured with tape on the cheek. Five pints of blood are cross-matched for use at the time of surgery. It is a mistake to attempt an esophageal resection with 1 or 2 pints of blood. The blood loss within the abdomen can be well controlled but in the thorax it is often unpredictable. A slow transfusion is started during the abdominal stage of the procedure. The second pint is added while the thorax is opened. The average transfusion volume has been 1,500 cc. during a five-hour procedure.

The patient is placed on the operating table on his back. A gallbladder rest is used in the usual position. A left vertical rectus incision is preferred, though a subcostal incision has been used on occasion. The important feature of the vertical incision is to begin it high enough between the xyphoid and the junction of the fifth and sixth costal cartilage. It should be extended to the left of the umbilicus and caudad for an inch or two. The wound is deepened into the peritoneal cavity, a muscle-splitting procedure being carried out. After the drapes have been applied, the liver is inspected and palpated for metastasis. The hand is then placed in the pelvis to determine the presence of any pelvic metastasis. When this has been done, the area about the celiac axis should have particular attention. No dissection of the vessels of the stomach should be done until the gastrohepatic omentum is broken through in an avascular area and both the left gastric artery and the celiac nodes inspected. On the whole, involvement of the nodes on the lesser curvature of the stomach with carcinoma is not a contraindication to resection *per se;* but if they are involved in such a manner that the left gastric artery is completely imprisoned in the mass and it cannot be identified either at its origin in the celiac axis or at its arrival and arborization on the lesser curvature of the stomach, we do not believe it is worth while to continue the operation. If the nodes, however, are confined for the most part to the lesser curvature of the stomach, adequate space can be developed between the mass of nodes and the aorta at the point of origin of the left gastric artery for safe double ligatures, then we believe that the nodes on the lesser curvature of the stomach are not a contraindication to resection in esophageal lesions which are in the middle or lower esophagus. However, if one is dealing with a lesion in the upper few inches of the thoracic esophagus, one cannot always resect a large portion of the lesser curvature of the stomach with the involved nodes which will be required with that type of nodal involvement and have a long enough segment of stomach to anastomose to the proximal esophagus at the dome of the chest. These decisions should be made, if possible, before any dissection is attempted. Since lesions in the upper few inches of the thoracic esophagus are relatively uncommon, this point will not arise too frequently. In a little less than 50 per cent of the cases some nodal involvement beneath the diaphragm will be evident, but this is frequently a cluster of metastatic nodes nestled at the esophagocardiac angle, which can be very nicely resected with the specimen with but a small sacrifice of a portion of the cardiac end of the stomach. Resection of this portion of the esophagus and cardia of the stomach is made by an oblique transection of the stomach and therefore it shortens the total length of the stomach very little.

When this study has been completed, dissection begins in the gastrocolic omentum, just peripheral to the gastroepiploic artery on the right, about an inch from the pylorus. If one passes the left hand through the avascular area of the gastrohepatic omentum, behind the stomach and using the third and index fingers,

elevates the gastrocolic omentum from behind, one can usually very readily find a free space to begin the dissection peripheral to the encircling right gastroepiploic artery. In tying the vessels it is well to leave about an inch of cuff on the branches of the gastroepiploic artery as they pass distally across the gastrocolic omentum; if they are cut shorter than this, the reaction about the tie may result in thrombosis of the gastroepiploic artery which would be serious in its consequences. We use No. 000 silk in securing the vessels. Dissection is carried between clamps peripheral to the gastroepiploic artery until one enters the region of the vasa brevia. There are a few avascular adhesions that usually pass from the middle of the posterior wall of the stomach to the pancreas. They should be divided at this point. One then delivers the stomach to the assistant who stands on the right side of the patient and the operator passes over to the left side. If the assistant elevates the stomach anteriorly, the operator can then pass his left index finger behind each of the vasa brevia in turn, using his right hand to manage the clamps, he may successively clamp and divide six or seven such vessels. If the spleen is mobile, the operator should place a gauze pack in behind the spleen so that it will deliver this organ a little further forward and bring the dissection closer. If the surgeon is not careful or his assistant tugs too severely on the stomach, the small delicate vasa brevia at the upper pole of the spleen will tear either from the stomach or the spleen. This will be a frequent, annoying feature of this operation and may lead to a splenectomy which otherwise would not have been necessary. Care, therefore, in approaching the upper border of the spleen and the short vasa brevia will be well repaid. It is good practice to divide the vasa brevia before one ties off the left gastric artery. This frees the fundus of the stomach, except for the peritoneal reflections to the diaphragm which are usually avascular.

A few points about the ligation of the left gastric artery may be of interest. The left gastric artery often reaches the stomach at very high levels and it is important to preserve the arcade of vessels which arborize after the primary divisions of this vessel. This occurs inconstantly but usually about an inch from the origin of the left gastric artery from the celiac axis. The assistant holds the stomach as aforementioned by the greater curvature, avoiding the gastroepiploic vessels and directing the greater curvature of the stomach anteriorly. The operator passes his left forefinger around the free border of the left gastric artery and coronary vein as they emerge at the upper border of the pancreas and palpates the position of the vessels. (Fig. 1.) With the patient in this position the vein usually lies medial and caudad to the artery. Using the finger as a guide to the place of dissection and then removing the finger and with a gauze sponge pulling the pancreas caudad and so putting the tissues on tension, one can generally, with the snub-nosed scissors, develop a plane in the areolar tissue about the left gastric artery, staying caudad and a bit lateralward so as to avoid the delicate coronary veins. The proximal tie on the left gastric artery should be placed as close to the celiac axis as possible. The distal ties should be placed about an inch from the proximal tie. This ligature (on the lesser curvature side) should be made without including too much areolar tissue so that when the stomach at a later time is pulled up into the chest, the tie will not tend to pull out with traction on the lesser curvature. If the distal ties are put too close to the lesser curvature, they will interfere with the collateral supply of blood from the right gastric artery through the arcades of the left gastric artery and a slough at the cardiac end of the stomach on the lesser curvature may result. When these ties have been made the left gastric artery with the coronary veins are cut through. A short mesenteric-like ridge of tissue now remains which contains small arteries and veins which are related to the left phrenic artery and vein. This ridge of tissue leads directly into the mediastinum. It usually is about 1½ to 2 inches long and should be dealt with kindly as very troublesome bleeding occasionally occurs if this ridge of tissue is not clamped, divided and ligated properly where vessels appear. If the entire fundus of the stomach through the highest vasa brevia is freed up before the left gastric artery is ligated, there will be ample exposure to deal with this region by merely continuing the traction of the stomach anteriorly. It should now be possible to introduce the forefinger of the left hand into the posterior mediastinum behind the esophagus. One again retracts the stomach toward the right side of the patient and, using the forefinger of the left hand, develops a cleavage plane between the esopha-



1 2

FIG. 1. Represents dissection of left gastric artery before ligation.

FIG. 2. Represents dissection of gastrosplenic attachments for delivery of fundus in preparation for ligation of left gastric artery.

gus and the crura of the diaphragm. With the forefinger indicating sections in turn the clamps may be applied on the esophageal and diaphragmatic side of the peritoneal reflection successively and the entire cuff transected with very little bleeding. (Fig. 2.)

It is particularly important to be certain that one does not divide both vagus nerves at this stage of the procedure. If this has been done inadvertently and the thoracic resection cannot be completed at a later time, a postoperative gastric dilatation may occur for the patient has been vagotomized and there may not be an adequate way of passing a tube into the stomach from above because of the obstructing neoplasm. This error may necessitate re-opening the abdomen, with the performance of a gastrostomy at the conclusion of the thoracic stage. Therefore, care should be taken to preserve at least one of the vagus nerves in the process of freeing the esophagus from the hiatal ring.

The dissection is now carried bluntly into the mediastinum for 2 inches by passing the forefinger posteriorly, laterally and anteriorly about the esophagus. The small amount of bleeding which follows may be controlled by gelfoam packs. Distally the dissection need not be carried down beyond the pylorus in any case where the lesion lies within the middle or lower thirds of the esophagus. The abdominal stage of the operation described usually requires from one to two hours, in our hands, depending on the type of costal arch, the level of the diaphragm and the obesity of the patient. The abdomen is closed with continuous chromic No. 00 on the peritoneum, interrupted silk reinforced with No. 30 fine wire sutures in the fascia and interrupted silk sutures in the skin. The patient's abdominal wound is protected with a small elastoplast dressing over gauze. While the operator and the assistants change gowns and gloves and rescrub for five minutes, the patient is turned on the left side, bringing the arms up in the praying position with a pillow supporting the left side of the thorax.

After proper preparation of the skin the patient is draped and a long incision made following the course of the sixth rib. The removal of the sixth rib seems to provide the best exposure in the average patient. If one spreads the retractors gradually and does not attempt to force them too quickly, the ribs, interspaces and costochondral joints will accommodate themselves and one may obtain surprisingly wide retraction after three or four minutes, where at first the exposure seemed quite insufficient. If additional exposure is needed, the fifth and seventh ribs may be divided at their necks. Our first procedure after entering the chest is to allow the lung to deflate gradually, assisting this by gentle pressure through a wet gauze pack. It is generally inadvisable for patients to be subjected to prolonged positive pressure anesthesia and one may, from time to time in older patients, find it profitable to remove the

packs and retractors, approximate the ribs with towel clips, re-inflate the lung and allow the patient to breath with a relatively closed thorax for five or six minutes before continuing the operation. As long as the patient is doing well, however, we do not interrupt the operation oftener than every forty minutes to perform any maneuvers of this kind.

With the patient on his left side and the lung packed off in the manner described, the azygos vein becomes very prominent. It is better to divide this immediately. Usually, even though the lesion is low, it will require division in order to obtain exposure for a satisfactory anastomosis. We use two ligatures of silk well spaced and divide the vein between the ligatures. There are a few very troublesome arterial branches arising from the intercostal arteries which reach the esophagus just beneath the azygos vein and which give rise to troublesome bleeding if they are torn, and therefore dissection beneath the azygos vein should be done gently. After this vein has been divided, the mediastinal pleura is opened down to the diaphragm. One gently frees the pleura from the tiny vessels that are lying immediately beneath it and apparently running over the lateral wall of the esophagus. As one approaches the diaphragm, one will visualize the hematoma in and about the area of esophagus that was dissected during the abdominal stage; and if, during the abdominal stage, one passed up a full forefinger's length through the hiatus, one will have no trouble leading the right forefinger beneath the freed esophagus. Using a curved clamp a Penrose drain may be slipped beneath the esophagus and used for traction later in the procedure. We do not deliver the stomach at this time. When the lesion has been palpated, it must be remembered that in the left lateral decubitus that portion of the esophagus which is not fixed by tumor will tend to deviate with the mediastinum toward the left side and, therefore, the esophagus will not be found immediately anterior to the vertebral bodies. Above and below the tumor it may be found well to the left of the vertebral bodies, especially in the lower 3 to 4 inches of its course.

If the lesion lies below the neck of the seventh rib, it may be adherent to the pericardium, to the vertebral bodies, to the aorta or to the lung root. Its adherence to the pericardium or lung root can usually be determined by attempting to dissect it free from this region. Its inseparable attachment to the vertebral bodies is much more easily determined with accuracy for when this situation is present, the tumor appears to be part of the vertebral body and fixation is complete with no tendency toward movement on palpation.

The adherence of the mass to the aorta is more difficult to determine with safety because the point of adherence lies in the depth of the mediastinum as it is presented to the operator. Statistically, however, in our experience we have not observed a case of carcinoma of the lower third of the esophagus below the neck of the seventh rib that invaded the wall of the thoracic aorta in such a manner it could not be removed safely without entering the aorta and yet had not already become massively fixed to the vertebral bodies, pericardium or lung. Therefore, in lesions in the lower third that can be freed anteriorly from the pericardium and are not fixed to the vertebral body posteriorly, we consider that in all likelihood they will be resectable and continue with the procedure.

In lesions that lie between D_7 and D_3 a considerable amount of judgment and experience will be necessary to decide when the risk of resection is justified as in this region the tumor may invade the membranous portion of the trachea or main bronchus of the right or left lung. The tumor may seem relatively small and yet have extensions projecting into the carina and cephalad along the left side of the trachea. Extensions in this location are often overlooked early in the operation. One can establish this point more accurately by dissecting anteriorly to the esophagus and attempting to determine whether it can be freed from the bronchi and carina. Since the right pulmonary veins and pulmonary arteries lie in a more anterior plane than the bronchus, it will be rare to find a mass which has involved all these structures.

In neoplasms of the upper third of the thoracic esophagus we are particularly interested in determining whether the mass is invading or partially surrounding the trachea and therefore we again work anteriorly, attempting to develop a cleavage plane between the esophagus at the level of the tumor and the membranous portion of the trachea. One can help oneself considerably at this point by dissecting anteriorly to the trachea itself but posteriorly to the innominate vessels so that finally one can pass one's finger anterior to the trachea and palpate that portion of the tumor

which is projecting toward the left behind the trachea and study its relation to the trachea and the carina. By this maneuver extensive masses of tumor will often be found along the left side of the trachea where the tumor, as felt from the right, may have presented only a small area of attachment to the right border of the trachea. One can appreciate from this description that as a rule we approach the tumor from its anterior aspect first, not only because the reasons for non-resectability are more often found anteriorly and on the left border of the esophagus but also because this dissection is usually bloodless. The blood supply of the esophagus enters from the posterolateral aspect of the organ below the level of D6. A major part of the blood supply entering the upper portion of the esophagus does so through the inferior thyroid arteries and the amount of bleeding which will be encountered posterior to the esophagus in the upper 3 inches of the thorax is relatively minor.

Having studied the tumor and decided that resectability is reasonably certain we then dissect posteriorly and anteriorly about the esophagus an inch or so proximal to the tumor, remembering that above the level of the azygos vein the esophagus can be encircled by blind dissection relatively easily without fear of profuse bleeding or dividing any large vessels. A Penrose drain is passed around the esophagus and gentle traction exerted.

Before attempting to dissect the tumor from its posterolateral attachments where most of its blood supply enters, one should be certain to have secured the blood supply of the distal esophagus. It may be argued that if one divides the distal blood supply to the esophagus after having mobilized the stomach and if for some reason one has miscalculated and is not able to remove the tumor, that an esophagus with questionable viability has been left in the mediastinum. Experimental work on dogs done in the surgical research laboratory of the Buffalo General Hospital, under the supervision of Dr. John R. Paine, has shown that large areas of esophagus may be devitalized without impairing the circulation of the esophagus sufficiently to cause death of the tissues with subsequent perforation. In fact, on more than one occasion in humans we have freed the distal esophagus up to the level of D6 after having mobilized the stomach in the manner aforementioned and have not been able to complete the dissection, and in none of the patients have serious consequences resulted. Therefore, we would urge the operator to mobilize the distal esophagus before attacking that part of the tumor which remains attached in the posterolateral area.

The method that has been found to be the simplest in securing the blood supply of the esophagus is to put traction on the distal Penrose loop with the left hand. In so doing some of the stomach will be delivered through the hiatus. With a large retractor held over a wet gauze pack compressing the diaphragm, there will be sufficient room to introduce long curved clamps posteriorly to the esophagus. We place these clamps about an inch from the esophageal wall itself. If the esophagus has been dissected anteriorly and has been raised from the vertebral bodies before this maneuver is undertaken, one will have only a ridge of areolar vascular tissue to clamp. The operator should be very careful with this particular phase of the procedure. A rent in the left mediastinal pleura, while if recognized may be of no immediate consequences, later in the postoperative period may be the indirect cause of fluid collections in the left chest as well as the right and complicate the care to a large degree. In addition, and what is more important, if a rent is made in the mediastinal pleura on the left and it remains unrecognized as such, it may well result in the death of the patient on the table through the gradual collection of trapped air in the left pleural cavity with compression atelectasis of the left lung.

We may introduce a point here which I believe is of some importance. It has been suggested by others that the onset of cardiac irregularities, including standstills during thoracic surgery, are frequently associated with subclinical levels of anoxemia which are masked by the anesthesia. The trapping of air in the left chest, under these circumstances, might result in very serious consequences of this sort rather rapidly. This complication may be avoided by passing the forefinger over the anterolateral surface of the esophagus *gently*, so that the pleura can be pushed away by the forefinger before the clamp is introduced posteriorly and being certain meanwhile to visualize, as well as palpate, the area that the clamp will secure. We do not use clamps on the esophageal side as the bleeding from this side is not troublesome. Clamps are placed on successively until the

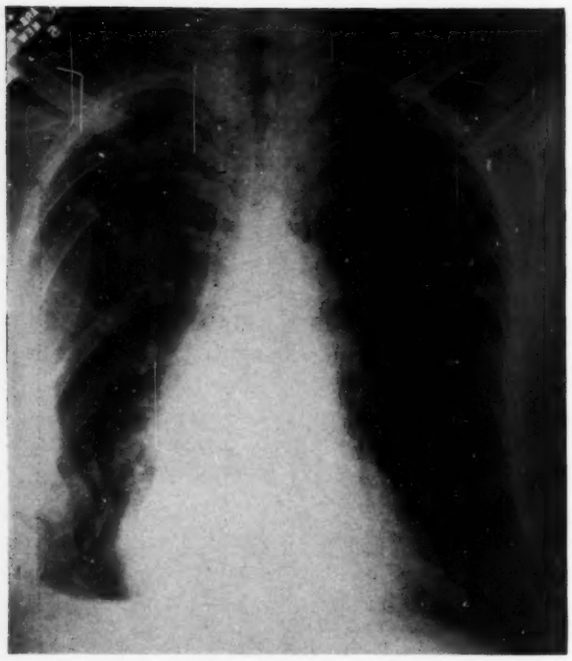


FIG. 3. Anteroposterior view of stomach behind right border of heart.

tumor is reached. It may be necessary to replace these clamps with ligatures in order to remove them from the wound so as to allow for better exposure.

If the tumor itself is not felt to be continuous with the aorta, one applies the fingers of the left hand anteriorly to the esophagus to define the limits of the tumor and using the right hand to place the curved clamp, one can insinuate it between the tumor and the aorta. This part of the operation is entirely dependent for its safety upon the adequate completion of the anterior dissection and the separation of the normal esophagus from the vertebral bodies above and below the tumor.

When the tumor mass has been dissected free, we continue the dissection proximally for 3 inches. This will frequently carry one above the asygos vein in low tumors and well up toward the apex of the chest in tumors of the middle third of the esophagus. At this point the mediastinum, which has been oozing a small amount of blood, is covered with a dry gauze pack; the lungs are re-inflated and ventilated for five or ten minutes. Clean wet gauze packs are then re-inserted. The stomach is delivered up into the chest and the esophagus divided at its junction with the stomach, unless metastatic nodes have been found at the esophagocardiac junction or on the lesser curvature. If suspicious nodes are present, that area of the stomach which involves these nodes is included in the specimen and the transection done obliquely remaining distal to the nodes; thereby, the attached nodes will remain with the esophagus and be removed with the specimen. If the esophagus can be divided at the esophagocardiac junction, we invert it with two rows of sutures. (Continuous atraumatic chromic catgut No. 000 on the first row with interrupted silk sutures in the second row.) If the line of section has been done through the stomach wall, we use three rows of sutures, using a Von Petz clamp and securing the suture line with a running mattress suture of chromic catgut inverted with one running layer of catgut, supported by a third layer of interrupted silk sutures.

With a clamp on the proximal esophageal side a dry gauze sponge is tied over the exposed surfaces of the esophagus or proximal stomach, as the case may be, and this clamp is delivered into the hands of the assistant standing to the left of the operator. He puts traction on the esophagus, lifting the tumor up from the floor of the thoracic cage. We try to make the anastomosis approximately 2 inches above the proximal end of the tumor. It is well known that this tumor often extends into the submucosa for great distances and we should like to avoid the unfortunate complication of having the tumor recur in the suture line within a few months of the operation.

We are now ready for the anastomosis. Gauze packs are arranged protecting the lung and pleural cavity. The stomach is laid in the mediastinum and tucked up posteromedially to the esophagus. While it appears to be posterior to the operator, actually the stomach is tucked medial to the esophagus because the patient is lying on his left side. Interrupted silk sutures are used, passing the suture through the stomach first, then through the wall of the esophagus 2½ inches above the upper border of the palpable tumor and then through the margin of the mediastinal pleura, lying at either side of the esophagus. This secures the stomach and mediastinal pleura to either side of the esophagus. Interrupted silk sutures on small curved needles are used to unite the stomach to the posterior wall of the esophagus. About seven or eight sutures are used in the posterior wall of the average case. Forceps or instruments are not used to steady the esopha-

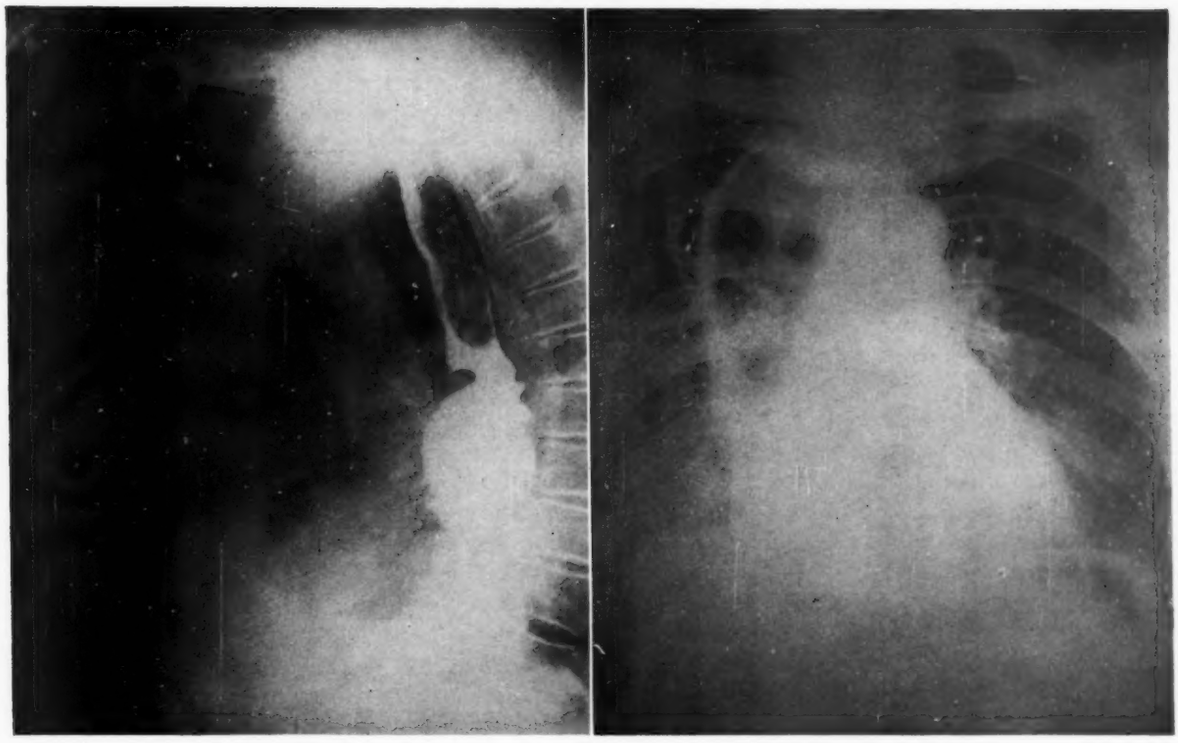


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FIG. 4. Lateral view of anastomosis.

FIG. 5. X-ray shows anteroposterior view of stomach lying in right chest with anastomosis above the arch.

gus for fear of injuring, fraying or disrupting the muscle tissue of this organ which is extremely friable. If not handled roughly, the esophagus heals very satisfactorily. (Fig. 3.)

The lateral and medial stay sutures are left long; the remainder are cut. A transverse slit is made in the gastric wall about ¾ of an inch from the suture line. A small section of stomach wall may be removed according to the suggestion of Sweet. One may see surprisingly free bleeding from the margin of the stomach when one transects it and enters the gastric lumen. If the vessels cannot be secured easily and sometimes they cannot because of eversion of the mucosa or difficulties of exposure, it is good practice to use a continuous atraumatic chromic suture which is hemostatic in effect and is passed over and over around the free margin of the gastric incision. This will control the bleeding effectively and allow visualization of the gastric edge of the suture line. Using a curved scissors the esophagus is partially divided approximately ⅔ of an inch from the first line of silk sutures, entering the lumen of the esophagus. Under direct vision fine silk sutures are used, interrupted in character, passing from the stomach side through the full thickness of the stomach wall then through the wall of the esophagus accurately approximating the mucosa and some of the muscle fibers of the esophagus to the mucosa, muscularis and serosa of the stomach wall. Eight to ten sutures of this type are used on the posterior row. Alternating sutures opposing mucosa above to mucosa are used between the larger sutures to complete the coaptation of the mucosal suture line. The esophagus is then cut across completely and the specimen removed.

Before entering the esophageal lumen it is well to have the anesthetist aspirate the tube which was placed in the proximal esophagus before surgery. Manipulation of the tumor during the dissection will result in a considerable amount of oozing and bleeding into this segment and this dark bloody fluid containing necrotic fragments of tumor will be found in the proximal esophagus and may flood the wound if the esophagus is opened without first aspirating the tube.

The anterior row is then completed by interrupted silk sutures, followed by a second row, uniting the muscular wall of the esophagus to

the seromuscular layer of the stomach. When this anastomosis has been completed, we suture the stomach to the margins of the pleura bordering the mediastinum, fixing the stomach in the chest so that the tension will be on these sutures rather than on the suture line. About six fine silk sutures are used on each side of the stomach in securing it to the pleura. (Figs. 4 and 5.)

One of the disadvantages of this operation has been that we have no adequate method of securing the hiatal ring to the stomach at the conclusion of the operation and there is, therefore, always the possibility of a loop of small bowel or colon passing through the hiatus from below and producing an obstructive type of hernia. When operating through the more conventional left transthoracic approach, one may apply sutures to approximate stomach to diaphragm anteriorly but posteriorly there is usually a large area which has not been completely closed off, and therefore, this hazard exists to a degree in both types of approaches.

If at the time of the abdominal stage of the combined approach as advocated here, the hiatus was very small, admitting only three fingers, it should be enlarged by splitting the margin of the medial crus of the diaphragm. Great care must be used in dividing this muscle belly. We use transfixion sutures along its margin in order to secure branches of the phrenic artery which frequently run in the margins of this crus. Care must be used to prevent injury to the thoracic duct which lies immediately behind the medial crus. The penalty for having pulled the stomach into the right pleural cavity through a tight hiatus may be a severe postoperative prepyloric obstruction extremely difficult to manage. Therefore, if the hiatus cannot be dilated up to four fingers at the time of the abdominal operation, the medial crus should be divided so that four fingers can easily be introduced into the mediastinum from below.

When the thoracic dissection has been completed, the packs are removed and a Petzar catheter used to drain the right hemithorax through the eighth intercostal space. It has been our experience that postoperatively 400 to 600 cc. of serosanguinous fluid collects in the right chest. We have found it easier to use closed drainage for three to four days than to aspirate this repeatedly as it tends to become pocketed and may be difficult to locate by x-ray because of the confusing shadows of the stomach in the right chest. There is also the danger of accidentally aspirating stomach contents. Before leaving the chest cavity, the catheter in the esophagus is passed down through the anastomosis into the stomach and drainage is maintained for forty-eight hours. The thoracic wound is closed with continuous chromic catgut sutures in the intercostal layer and interrupted silk on the muscles and skin. The bronchial tree is aspirated before removal of the intratracheal tube.

Postoperative Care. Patients should remain in an oxygen tent for twenty-four hours; penicillin, 100,000 units every three hours is used in conjunction with streptomycin, .5 gm., twice a day. The duodenal tube is left in the stomach for forty-eight hours but after twenty-four hours the patient is allowed 2 dr. of water every hour by mouth. The amount is doubled daily until 2 ounces per hour is reached on the fourth day. Patients are graduated to a bland diet on the eighth day. We believe in early ambulation and encourage patients to get out of bed after the first twenty-four hours, though we do not force them to do so if too debilitated. Adequate parenteral fluids are given, including 1,000 cc. amigen daily, sufficient to support a urinary output of over 1,200 cc. per day until oral intake is satisfactory. The thoracostomy tube usually stops draining on the third day and is removed at that time. Patients often leave the hospital between their tenth and fourteenth postoperative day.

SUMMARY

An attempt has been made to outline some of the reasons for preferring the combined approach, through the right thorax in resection of the esophagus. It has been suggested that for the average, competent, well trained surgeon who has frequent occasion to operate upon patients with esophageal neoplasms this approach is on the whole an easier operation for both the surgeon and the patient and is likely to be followed by less complications than the more conventional left transthoracic approach. An effort has been made to describe some of the problems that arise during this type of surgery and to suggest methods that have been used by the author to meet these problems. This paper has been written largely for the general surgeon who has the opportunity to do an occasional esophageal resection and who, by experience and training and by the standards,

services and equipment of the hospital in which he works, is justified in performing this type of resection.

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Many cases of duodenal diverticula arise on the pancreatic side of the third and fourth portions of the duodenum; but whether they are single or multiple, they require only surgical treatment if they are causing persistent symptoms as pain, nausea or hemorrhage. Although excisable, the simplest procedure is to invert them and firmly repair the defect in the duodenal wall at their base. If they are hard to find, the surgeon can inflate the duodenum with air and even insert his finger into the distended diverticulum to facilitate its dissection from the pancreas. Some authorities fear injuring the common bile duct so they temporarily intube this structure (and thus make sure to avoid it) while dissecting a diverticulum in its neighborhood. (*Richard A. Leonardo, M.D.*)

TUMORS AND PSEUDOTUMORS IN THE NECK

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SWELLINGS in the neck can usually be identified by a careful history and physical examination because each enlargement has certain characteristics and tends to appear in a fairly consistent location. In cases in which the diagnosis is not clear simple biopsy should be employed.

PHYSICAL SIGNS

If a mass moves upward on swallowing, it is either an enlarged thyroid gland or it is connected to the thyroid. If a mass moves upward on protruding the tongue, it arises from the thyroglossal duct. Multiple swellings are almost always found to be enlarged lymph nodes. If pressure over a swelling in the neck causes fluid to appear in the throat, one should be suspicious of a branchial fistula or esophageal diverticulum. If a mass pulsates in all directions (expansile pulsation), it is probably an aneurysm. Vascular swellings are compressible whether neoplastic or not. Diverticuli of the esophagus or pharynx empty on pressure. Cystic hygroma may seem to compress if deep loculi are present.

Ptosis, ophthalmoplegia and a mass of secondary enlarged nodes in the neck may indicate a primary lesion in the nasopharynx.[2] The tonsillar lymph node, located just under the angle of the mandible, may be involved rarely by tuberculosis but commonly by drainage from infected tonsils.[35] Mollison states that when a patient presents himself with a hard lump in the neck and cotton in the ear, he is probably suffering from carcinoma of the deep pharynx.[4] Draining fistulas on the lateral side of the neck are commonly due to branchial fistulas; those in the midline anteriorly are due to thyroglossal fistulas.

Pulsation may be transmitted in one direction from underlying arteries which have no connection with the mass (transmitted pulsation), from an artery which is adjacent to the mass (carotid body tumor) or may be mimicked by the expansile pulsation of an aneurysm.

When one feels a mass that is fixed, the first impulse is to assume that it is of a malignant nature.[6] Actually inflammation early fixes a swelling. In contrast, malignant tumors are not fixed until infiltration occurs.

If the edge of a mass is sharp and clearly defined, consider first a benign tumor. Inflammation is suggested by poorly defined margins and malignant tumors by intermediate grades of fixation.[7]

A hard swelling may result from a streptococcal or staphyloccal infection or from a neoplasm.[6] A tender mass indicates that increased tension is present and that inflammation is the probable cause, although a rapidly enlarging neoplasm may be tender, either in the neck or the breast. A warm swelling has the former significance.

It is not uncommon for a patient to complain of a swelling in the neck and for the physician not to be able to detect one. The patient may have felt a normal structure in the neck, as for example the hyoid bone, or he may be able to feel a minute swelling before the physician is able to do so. Re-examination in a week or two will tend to clear the issue.

Consistency is not an altogether reliable sign in neck swellings. An adenoma of the thyroid is paradoxic as far as fluctuation is concerned; the solid variety feels cystic and the cystic variety feels solid.[2]

Put on dark glasses, used in fluoroscopic eye adaptation, and examine the neck and anterior chest wall for dilated veins. Dilated veins noted on the upper chest wall may be due to a retrosternal goiter and pressure on the internal jugular vein or to a mediastinal tumor. The sign of emptying indicates a diagnosis of cavernous hemangioma.[4] If a swelling of the neck appears when the patient blows his nose, one must consider laryngocele, a narrow necked pouch connected with larynx.

To determine the depth of a lateral cervical swelling one must determine whether it is inferior or superior, superficial or deep, to the sternomastoid muscle. Stand behind the patient and ask him to push his chin firmly against your hand. This procedure tenses the sternomastoid

muscle and enables one to palpate along it, thus differentiating it from the swelling.[4]

On finding a lymph node enlarged in the left supraclavicular area remember Troisier's sign. Lesser curvature gastric carcinomas may metastasize to this nodal area.

Lymphadenopathy calls for examination of the axillas, groins and other lymph node areas to rule out lymphoma. Local lymphadenopathy calls for examination of possible sources of infection or primary growth, that is, tonsils, mouth, ear, scalp, tongue. The location of the enlarged nodes helps to indicate the primary source.

A small abscess may be of the collar-stud type in which a deeper suppurating gland has broken down and released a small amount of pus to the subcutaneous tissues.[2]

In the neck, axilla and groin pea-sized, nontender lymph nodes are occasionally felt in normal children.[3] Often they are the residual manifestations of preceding infections in the skin or respiratory tract which drain into the region.[8]

DIAGNOSIS BY LOCATION

Midline Anterior Neck. A thyroid gland enlargement moves with swallowing and is located in the inferior aspect of the neck. Movement of the thyroid with swallowing occurs because the gland is bound to the larynx by the deep cervical fascia. This movement may sometimes be better seen than felt. Directly under the point of the chin one may find an enlarged node, the submental lymph node.

A mass or fistula in the midline anteriorly and located in the superior portion of the neck may be a thyroglossal cyst or fistula. Have the patient stick out his tongue. If the mass or fistula moves up when he protrudes his tongue, a diagnosis is established that it is of thyroglossal origin. A dermoid cyst (teratoma) may be found in the midline anteriorly.

One should remember that in the midline and adjacent area the thyroid and parathyroid glands, larynx and trachea, esophagus, thyroid embryonic rests and possibly the upper reaches of a large thymus gland are normally located.[9] Pathologic process may begin in one of these structures and extend to some distance before presenting itself or may metastasize elsewhere.

The hyoid bone is the most superiorly placed bone in the neck.[10] The greater horns of the hyoid protrude posteriorly for a considerable distance. Many persons complain of pain on palpation of these horns and mistake them for a tumor or enlarged lymph nodes.

Submaxillary Area. Enlarged lymph nodes are by far the commonest swelling in this area of the neck. Remember that the tonsillar node at the angle of the mandible is not only involved by tonsillar infections but also that tuberculosis often affects it first. Lymphadenitis, metastasis and lymphoma, for example, Hodgkin's disease, are found in that order.

The submaxillary gland itself may be enlarged due to duct obstruction. In this case the gland swells intermittently on mastication or smoking, with movements of the small calculus in the duct. If infection and inflammation are added, persistent swelling of the gland appears and pus may usually be pressed from the end of the duct in the floor of the mouth. The submaxillary gland may be enlarged due to mumps, as may the sublingual gland. Superficial nodules attached to the skin are commonly benign epidermoid cysts.

Parotid Area. Mumps is the most common cause of parotid gland enlargement. Parotitis, with or without duct obstruction, is next most common and tumors of the parotid third. Parotid swellings typically surround the lobe of the ear, usually abducting it from the body.

Parotid swellings fill up the normal depression below and anterior to the lobe of the ear. Parotitis, whether caused by mumps or bacterial infection, results in a horseshoe shape type of swelling anterior, inferior and posterior to the lobe of the ear. Bilateral parotid swelling may be of bacterial origin.

If there is a question of parotitis, squeeze along the line of the duct and see if pus is expressed from the orifice which lies inside the cheek close to the second upper molar tooth. This duct may be injected with lipiodol or other radiopaque oil to demonstrate obstruction or dilatation of the duct. If the patient clenches his teeth, the masseter muscle is contracted and the portion of the gland in front of the auricle is easily palpated and seen. Recurrent attacks of parotid swelling and pain may be due to sialectasis, a dilatation of the ducts and alveoli, caused by obstruction of the duct.

As a rough guide in differentiating mumps from cervical adenitis remember the old adage, "The swelling of lymph nodes is lower on the neck than that of mumps." Hatchcock's sign for early mumps consist of tenderness when

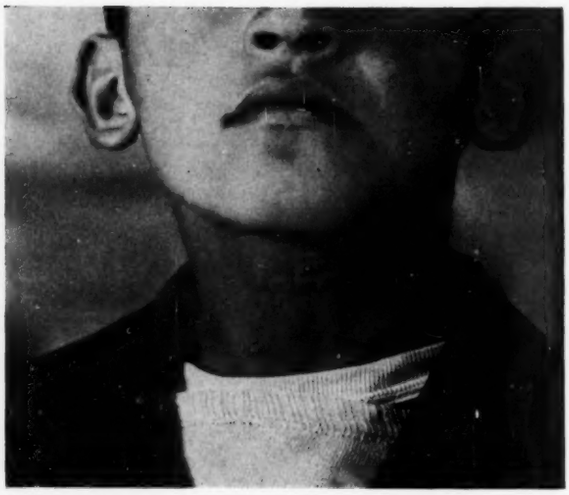

FIG. 1. Postoperative appearance of a patient with a thyroglossal fistula which was excised with a segment of the hyoid bone; there is some keloidal tendency.

FIG. 2. Postoperative appearance after excision of a cystic hygroma.

palpating along the inferior margin of the mandible toward the parotid region. Pain on palpation in the area of the angle of the mandible is present even before the parotid gland can be seen or felt as enlarged. The edges of the gland are indistinct when mumps is present, being difficult to outline clearly.[5]

Lateral Region of the Neck. In the anterior and posterior triangles certain swellings are to be found. Enlarged lymph nodes are again the most common swellings due to local infection, metastasis or lymphoma, such as Hodgkin's disease.

A branchial cyst is a soft, compressible swelling which gives the sensation of feeling a half empty hot water bottle. It usually appears anterior to the sternomastoid and is moderately high on the neck. If such a cyst has been drained, it will intermittently discharge material from the external opening or into the throat. In some cases such a branchial fistula has been present since early life.

A turberculous abscess often presents itself in the lateral region of the neck and may be somewhat similar to a branchial cyst. A cystic hygroma may appear here but can be easily detected as it is the only brilliantly translucent swelling in the neck when a light is placed so that the swelling is transilluminated.[11–15] A carotid body tumor appears at the bifurcation of the carotid into external and internal arteries. An esophageal diverticulum can usually be identified by its emptying on compression, with a gurgle and by roentgen evidence.

Posterior Triangle of Neck. In this area one may find fatty tumors, dermoid cysts, sebaceous cysts, infections such as furuncle and carbuncle, cystic hygroma[16] and meningocele. They may be differentiated by the criteria given previously.

CASE REPORTS

CASE I. *Thyroglossal fistula:* At the age of two a clear, thin-walled sac had appeared in the anterior midline of the neck in this patient. The sac had been incised and since that time intermittent discharge of mucoid secretion occurred over the four-year period. The fistulous opening moved up when the patient protruded his tongue.

The fistula was removed on June 4, 1946, under general anesthesia through a transverse incision. Dissection was continued to the hyoid bone and a segment removed from its center (Sistrunks technic) to avoid reformation of the fistula. There has been no recurrence in the five years since that time. Figure 1 indicates the postoperative appearance of the keloidal scar.

CASE II. *Cystic hygroma:* This three year old boy had been in good health until August, 1948, when a mass appeared spontaneously in the posterior triangle. The mass was the size of a flattened orange, fluctuant, non-tender and was not related to any other structure in the region. Complete physical, laboratory and roentgen examinations revealed no abnormalities. The cyst gradually increased in size.

On August 23, 1949, the mass was incised through a curved incision in the hair line above the mastoid area. (Fig. 2.) The cystic hygroma was adherent to muscle, fascia and periosteum. It consisted of many small cysts containing a

clear, yellow fluid which extended along the sternomastoid muscle and the temporal bone.

The pathologist's report revealed lymphangioma, cystic hygroma. Sections of cystic lesions showed many irregular spaces lined with flattened or polygonal cells which appeared to be endothelial in origin. These spaces were surrounded by areolar tissue and skeletal muscle. There was considerable fibrosis and chronic inflammation. Occasional, irregular, thin-walled, vascular structures were filled with blood and there were areas of hemorrhage. Also there were several areas of chronic inflammation containing "cholesterol clefts," large phagocytal "foam cells" and foreign body giant cells.

There has been no recurrence in the intervening two years and the incision is well hidden under the hair line.

CASE III. *Branchial fistula:* This thirty year old male had been troubled by a draining sinus on the left side of the neck which had been present as long as he could remember. It had been treated with local injections and attempts had been made at suturing the external opening. In recent years the patient had noted a bad taste in the mouth which could be reproduced by pressing along the fistular tract in the neck, with expulsion of foul-tasting material into the throat. Occasional attacks of inflammation occurred in the fistula.

Complete physical, laboratory and roentgen examinations indicated no abnormalities other than the draining sinus which opened low on the left side of the neck just anterior to the sternomastoid muscle. Pressure along the tract caused yellow pus to appear between the left posterior pillar and left tonsil. Ionized oil was injected into the fistula with difficulty; air and oil permitted the fluid to pass along the tract and appear in the throat and roentgenogram.

On February 27, 1949, the branchial fistula was removed through two incisions made into creases in the neck (Fig. 3.) after Bailey's technic. Injection of methylene blue in hydrogen peroxide and insertion of a probe permitted dissection of the tract up to the upper incision. The fistula was then pulled into the upper incision and the remainder of the dissection made up to the left side of the pharynx. Oxidized gauze was packed into the deeper regions of the tract. The patient ate readily in twenty-four hours. Healing was uneventful and there has been no recurrence in two years. Figure 3 indicates the postoperative appearance.

FIG. 3. Postoperative appearance after excision of a branchial fistula through two incisions along neck creases (Bailey's technic).

The pathologist reported a branchial cleft sinus in the neck. Sections showed a cystic space lined in part by stratified squamous epithelium and in part by respiratory type epithelium. Beneath this there was a rather thick zone of lymphoid tissue which was collected into well formed follicles. The lumen contained blood, cellular debris and protein precipitate. There was considerable skeletal muscle about the tract as well as mixed glands, probably salivary.

CASE IV. *Lymphadenitis secondary to tonsillitis:* A thin youngster of four years exhibited nocturnal dyspnea and orthopnea. A large, inflamed left tonsil and a moderately enlarged right, infected tonsil were found in the throat. At the left angle of the mandible the tonsillar lymph node was found to be firm, round, nontender and enlarged to the size of an orange. Complete physical, laboratory and roentgen study was negative, except for a white blood cell count of 12,000, neutrophils 58 per cent, eosinophiles 5 per cent, lymphocytes 29 per cent, monocytes 8 per cent and roentgen evidence of definite retardation of bone growth in the wrists.

Roentgen therapy gave immediate relief and decreased the size of the cervical node. After six months had passed the left tonsilar node began to enlarge and soon attained its previous size. The parents were very apprehensive because of offhand comments by physicians about the possibility of Hodgkin's disease or leukemia. (Small nodes could be palpated in cervical, axillary and inguinal areas; these remained unchanged after one year's observation.)

I removed the enlarged left cervical node on December 24, 1946. The pathologists report was

that sections of the lymph node showed hyperplasia of both lymphoid and reticuloendothelial elements. Architecture was preserved. The capsule was thickened and scarred with some fatty infiltration. Areas of recent hemorrhage were seen. There was no evidence of malignancy and the diagnosis was chronic hyperplastic lymphadenitis.

Tonsillectomy and adenoidectomy was then performed and the youngster's health has been much improved since that time. On April 5, 1949, I removed a long, injected appendix, following repeated attacks of appendicitis. Pathologic examination revealed a small lumen and a tunica propria mucosae thickened by hyperplastic lymphoid tissue. The lumen contained a small amount of pus. Diagnosis was acute appendicitis.

CASE V. *Submaxillary gland stone:* This sixty-four year old man had noted a mass under the left side of the jaw for ten years. The swelling varied in size from time to time. For ten days he had noted pain in the left side of the neck and mouth.

The submaxillary gland was swollen and tender on palpation. The left side of the floor of the mouth was edematous and deeply indurated being part of the mass in the neck. The orifice of the submaxillary salivary duct (Wharton's) exuded pus.

The duct was incised and a long, oval, salivary stone together with thick pus removed. The stone measured 2.5 by 0.5 cm. There was rapid subsidence of swelling and pain and no recurrence of symptoms or enlargement of the gland since February, 1946.

CASE VI. *Nodular thyroid:* A fifty-seven year old man had noted a gradually enlarging mass in the right, anterior, inferior region of the neck during a period of more than ten years. Toxicity became evident, both clinically and with a demonstration of plus sixty in the basal metabolism test.

Propylthiouracil was taken during one-year periods with some improvement in symptoms, decrease in tachycardia and basal metabolism to plus twenty-three, but the patient failed to gain weight and strength.

A large, firm mass which moved up on swallowing was found in the neck. On January 4, 1951, it was removed under general anesthesia. The pathologic diagnosis was colloid nodule with hyperplasia and involution.

Weight gain and increase in strength has been consistent since that time. This supports the current view that antithyroid medication only represses hyperthyroidism.

CONCLUSIONS

Enlargements of the neck may usually be diagnosed by physical examination if certain rules of location and physical characteristics are kept in mind. Biopsy should be resorted to for any persistent, localized swelling in the neck.

Acknowledgment: Several of these illustrations appeared in the Iowa State Medical Society Journal and are reproduced by courtesy of the editor.

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ILEOSTOMY—EVOLUTION AND CLINICAL MANAGEMENT

WITH A DESCRIPTION OF A NEW ILEOSTOMY BAG

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THE indications for permanent ileostomy and the place of ileostomy in the surgical armamentarium have, in recent years, become increasingly standardized and more widely accepted. In fact, one might say that as the management of an ileostomy improves and its acceptance spreads through the surgical world the potential therapeutic value of the procedure is being more nearly realized.

The historical evolution of a terminal ileostomy is somewhat obscure. We know that enterostomies were performed in the eighteenth century but terminal or single-barreled ileostomy is not documented. Renault in 1722[1] performed gastrostomy and enterostomy on the same patient but the enterostomy was probably for feeding and not related to ileostomy as the term is used today. According to Strombeck,[2] Follet in 1885 did the first cecal fistula operation as a therapeutic attempt to put a diseased colon at rest. Brooke[3] credits Weir with first using the appendix to irrigate and medicate a diseased colon in 1902. Trimpi and Bacon[4] report that this method still enjoys favor in some European clinics, and indeed it is still a worth while procedure in Hirschsprung's disease. In 1900 Howard Lilienthal[5] of New York performed a total colectomy with ileoproctostomy on a young woman with severe ulcerative colitis, with recovery, and for his daring attack on this dread disease deserves great credit. The patient has subsequently been reported by Cave[6] as surviving over forty years, to die eventually of the side effects of hypertension. In spite of the obvious disadvantages and the problems in management of an ileostomy surgeons were forced to use it as the only answer to certain problems, and the incidence of ileostomy has steadily increased. At the present time it is the accepted end result of the surgical therapy of chronic ulcerative colitis. The pioneers and leaders in this field are generally agreed that any patient with chronic ulcerative colitis requiring ileostomy should undergo colectomy and that the ileostomy should be considered permanent. Furthermore, ileostomy should not be reserved for the moribund patient as has been too often the case, thus creating an extremely artificial mortality rate for the operative procedure.

Accepted indications for colectomy and ileostomy[7,8] in chronic ulcerative colitis are: (1) medical failure—acute fulminating type and chronic; (2) obstruction; (3) perforation—acute and subacute with abscess or fistula; (4) hemorrhage; (5) severe constitutional changes; (6) pseudopolyposis and (7) malignancy. Diffuse polyposis, familial or non-familial, should be treated with total colectomy and permanent ileostomy. I do not believe subtotal colectomy followed by ileoproctostomy with rectal fulguration is warranted unless the rectum is completely free of polyps and even then the patient may develop ineradicable malignancy while under close observation. By far the majority of permanent ileostomies will result from the aforementioned diseases but in additional individualized cases, such as extensive trauma or multiple malignancies of the colon, ileostomy may represent the procedure of choice.

TECHNIC OF ILEOSTOMY

When we consider the technic of ileostomy we find that the early literature on this procedure reflects the anxiety of the surgeon to eliminate the ileostomy as soon as possible. Thus the initial operations were designed to facilitate the closure of the stoma at the second operation, often at the expense of efficient diversion of the fecal stream. The John Young Brown method as recommended by Rankin, Bargen and Buie[9] found considerable favor and consisted of dividing the terminal ileum, dropping back the closed distal end and tying a tube in the proximal end. Another tube was then inserted in the cecum and brought out through a stab wound. When continuity was to be re-established, the cecal fistula was closed, the ileal fistula excised and the proximal ileum anastomosed to the cecum or ascending colon.

Harvey Stone modified this procedure by doing a Halsted bulkhead anastomosis between the divided ends of ileum and making a proximal side opening in the ileum. This was combined with a cecostomy for irrigation of the colon. Continuity was re-established by dividing the bulkhead using a Halsted enterotome, following which both fistulas were closed. An ileostomy today should fulfill the following criteria as listed by Cattell,[10] as well as an additional one which is important:

Favorable Position. This should be interpreted as located at a point allowing sufficient flat expense of abdominal wall to accommodate a receptacle, avoiding the umbilicus, iliac spines and flexion creases, and will usually lie at about McBurney's point.

Inconspicuous. This I do not believe is of vital importance and will be determined chiefly by the appliance used and not by any innate quality of the ileostomy.

Free from Incision for Colectomy—if Done for Chronic Ulcerative Colitis. Preliminary ileostomy is rarely necessary for polyposis and may be combined with one-stage colectomy. This is important because a "mature," well adjusted ileostomy is a great asset and should be left undisturbed at the time of colectomy if possible. This may be accomplished by dividing the ileum, bringing the proximal end out through the lower angle of the right rectus incision and exteriorizing the distal end through a lateral stab wound.

Firmly Fixed in Abdominal Wall to Prevent Prolapse or Retraction. Nature will securely fix the ileum in the anterior abdominal wall and prolapse is usually mucosal in nature. The ileum should not be sutured to the skin. However, clinical judgment in closing the wound around the ileum seems to be the major factor influencing the incidence of this complication. If a muscle-splitting incision is used, I believe a cruciate incision in the aponeurosis of the external oblique may prevent constriction and the development of an adventitious opening, a complication which is very distressing and requires immediate revision of the ileostomy.

Place as to Avoid Obstruction. This point is stressed to emphasize the importance of exteriorizing the ileum in a favorable relationship to its own mesentery and the anterior abdominal wall. It is entirely too easy to rotate the ileum 180 degrees unless this is carefully avoided.

Sufficient Projection to Protect Skin. If all the previous criteria are carefully observed, they are worthless unless the ileum protrudes above the skin level. In my opinion 2 cm. is a minimum length for satisfactory management and 3 or 4 cm. is preferable. It should be kept in mind that an overly long stump can always be amputated very readily.

In addition to these points the surgeon should not consider the task completed until he has assisted the patient in adjusting himself to the ileostomy, educating him carefully and patiently in its care. The patient should not be given the address of a mail order appliance house and sent home, left largely to his own improvisations.

Careful fixation of the mesentery of the ileum to the inner surface of the parietal peritoneum has been stressed by Dennis[8] and others but does not seem to warrant the importance attributed to it since we have not incorporated this operative feature and have seen no cases of troublesome prolapse.

In the immediate postoperative period the management of an ileostomy is usually rather simple. We prefer to tie a curved glass Paul tube into the protruding ileum and lead the contents into a glove via a Penrose drain anchored over the end of the Paul tube. The stump is supported by dressings to avoid angulation with circulatory embarrassment. If irrigation or intubation is required, the Penrose drain may be removed and the ileum intubated through the Paul tube. This has seemed more satisfactory than any type of intubation and avoids the danger of compressing the ileal wall between a rigid tube and the anterior abdominal wall. The glass tube will usually remain in place for seven days and may be reanchored after the original purse-string suture has sloughed away. It does not prevent ambulation but should be carefully supported by protective binders. The emphasis of Lahey on daily inspection of the bowel to determine the state of vascularity is well worth while and may prevent a serious slough into the abdominal wall. The utilization of a large sheet of rubber dam into which the ileum protrudes and empties is a rather common method of handling the fresh ileostomy and deserves a word of warning. The opening in the rubber dam must not constrict the bowel, especially in the immediate postoperative period when it is very tender. There seems little doubt that perforations have been

produced in this manner. When the ileal wall has thickened and become more resistant, this is less likely to occur. Other devices proposed for the early care of an ileostomy include the suction tube advocated by Lium,[11] a metal plate with an Irving box and constant suction,[12] the ileostomy pan of Levy,[13] the Shoelson plate,[14] the Grenfeld pouch,[15] the Traveller bag[16] and many others. As late as 1947 Black and Thomas[17] in discussing the surgical treatment of chronic ulcerative colitis stated that "the only consistently beneficial procedure is creation of an ileac stoma, the most discouraging complication of which is the excoriation of the surrounding skin. No appliance is universally successful."

In 1948 Saunders[14] in describing his experiences with the Dragstedt type of ileostomy and the Shoelson appliance stated "the therapeutic efficiency of ileostomy is antagonized by the morale-destroying elaborateness and messiness of the dressing care needed to reduce or avoid skin excoriation in patients with ileostomy." He evaluated the Shoelson appliance as follows: "The disadvantages of this weighty appliance should be overcome in the future by substitution of molded transparent plastic material which also could be more easily cleaned."

Milestones of progress in the management of ileostomy include the skin-grafted ileac stoma as described by Dragstedt and the Koenig-Rutzen bag. Bargen[17] in discussing the report of Black and Thomas[16] praises the "skin grafted ileostomy as the single greatest surgical advance in the treatment of ulcerative colitis." This remark must be interpreted in the light of the ileostomy appliances in vogue at that time. We have not found it necessary or desirable to use the Dragstedt technic, the finished product being considerably bulkier and more unsightly than is necessary. The Koenig-Rutzen bag was developed by a patient of Dr. A. A. Strauss[18] in Chicago, whose name should not be overlooked in discussing ileostomy since this pioneer has been using ileostomy as a routine adjunct to resection of the colon for over thirty years. In addition, he has advocated ileostomy for chronic ulcerative colitis since 1914 and has personally performed over 500 ileostomies with a mortality below 4 per cent. The Rutzen, or Koenig-Rutzen bag, has a thin brass facing covered with rubber and an exit spout at the bottom. The revolutionary feature of this bag is that it glues to the skin,

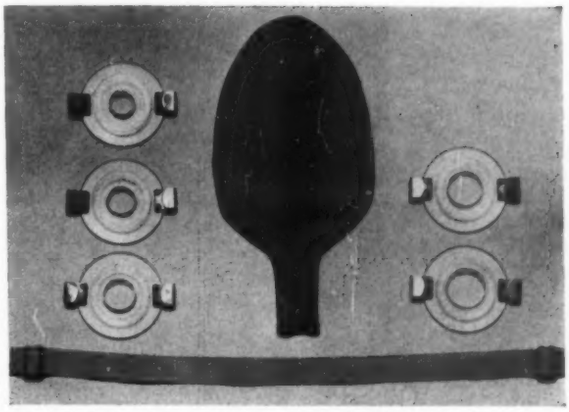

FIG. 1. Complete ileostomy set showing the five discs of varying size bore, the bag and the belt.

thus affording in theory at least a water-tight opening. Facing compound is applied to the bag and rubber cement to the skin. The glue is sufficiently strong to hold the bag in place without a belt although one may be worn with it. Many people find that this bag effectively manages an ileostomy as well as the so-called "wet colostomy." The use of glue is, however, an obvious disadvantage to be overcome.

Another device is the Torbot bag, made by two ileostomized patients of Doctor Lahey. They ground down a disc of lucite so that a pulley resulted, with convexity of the skin side, which was affixed with glue as in the Rutzen bag. The ileum protruded through a custom-made bore and discharged into a bag anchored over the outer wheel of the pulley. In addition to the use of glue, this appliance shares another common disadvantage with the Koenig-Rutzen bag in that they are both distributed as mail order items in which the mail order house deals directly with the patient. It occurred to me that it might be possible to make a better ileostomy bag and at the same time make it available to the surgical world and the surgical patient as are all other bonafide surgical supply house articles. Accordingly, we have produced a bag which is certainly a descendant from the Torbot family. (Fig. 1.) This disc is made of polystyrene because we found two patients who were allergic to lucite. As yet no one has shown such a reaction to polystyrene. It is also cheaper. It is molded (as suggested by Saunders several years ago) and thus is much smoother than one produced on a lathe. The bore is $\frac{7}{8}$-inch with enough material to allow reaming to $1\frac{3}{8}$ inch. It may be glued to the skin, but at present of the twenty patients using this bag

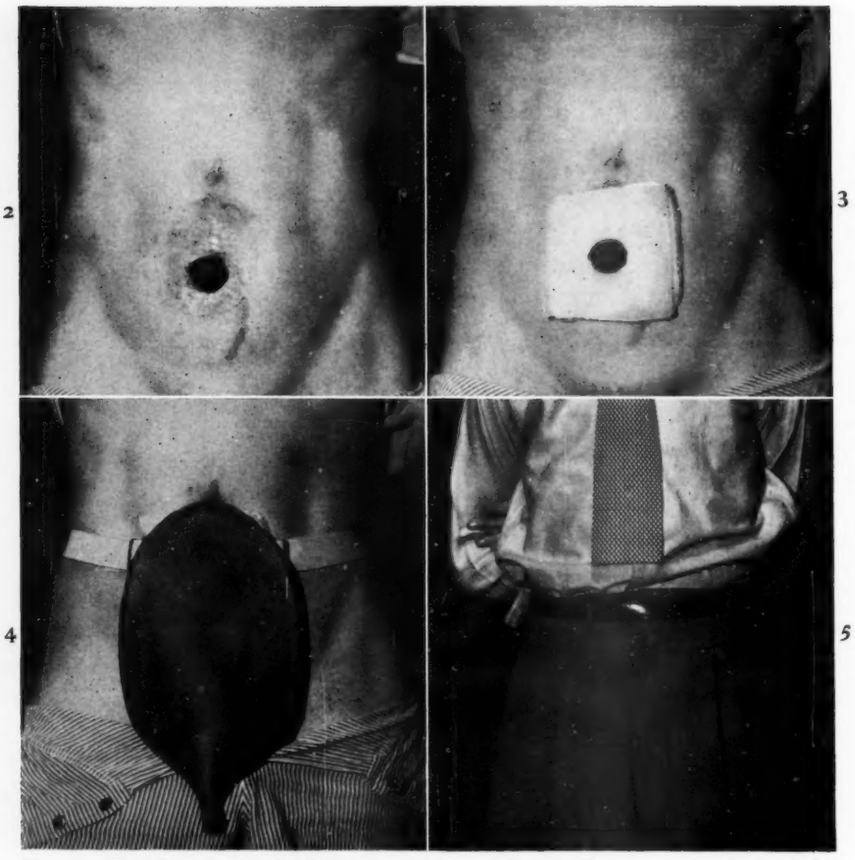

FIG. 2. Total one-stage colectomy with permanent ileostomy performed for chronic ulcerative colitis in June, 1950. Note the absence of skin excoriation.

FIG. 3. A fenestrated square of gauze, overlain by a similar square of rubber dam, is applied by the patient on arising. It need not be charged for twenty-four to forty-eight hours.

FIG. 4. This shows the bag in place. We believe that the support afforded by the rigid disc, securely held, may be a factor in preventing prolapse and herniation.

FIG. 5. This appliance is very inconspicuous. This patient is a high school senior and very active athletically including swimming.

none use glue. As far as I know, no other ileostomy bag is effective unless cemented to the skin. The technic is shown in Figures 2 to 5. The rubber dam seems to serve as a gasket. The dressing should be changed every twenty-four hours and the bag emptied as indicated, usually every five to six hours during the day. The clips on the disc are of stainless steel and resistant to the digestive juices. The belting is quite cheap and can be washed or replaced as indicated.

This bag will not work on a short ileostomy, nor am I familiar with any bag that will do so. Leakage has been a problem in one patient but it seems to occur only at night. This lady demonstrated an unusual complication of ileostomy as she weighed almost 200 pounds. The average patient with an ileostomy is rarely so well nourished. At any rate, as the patient lay on the operative table following total one-stage colectomy for familial polyposis, her upper abdomen seemed to present a flat and favorable surface for the installation of an ileostomy; but when she sat up, her ileostomy bag was elevated by an epigastric roll of fat. This problem was resolved by performing epigastric lipectomy to stretch the abdominal skin. This is a recent case but sufficient time has elapsed to show a great deal of improvement. Incidentally, this patient was unable to glue any bag to her skin without a skin eruption.

Before leaving the subject of ileostomy bags I should mention the Gladstone[19] disposable plastic bag, the Dennis-Ward[20] lucite bag and

the Pierce wet colostomy bag although we have had no personal experience with them. It is gratifying, however, to see reports on new appliances for as a result of such cumulative efforts the problems of management presented by ileostomy may eventually be completely solved. It should be emphasized that if the technical aspect of collecting the ileal discharge, without leakage, can be controlled, these patients can lead a completely normal life in every respect including swimming, golf, tennis, dancing, and in one documented case, professional football. I have come to believe that the well managed ileostomy is less of a nuisance to the patient than a well managed colostomy; and when ileostomy becomes as accepted as colostomy among our internists and gastroenterologists, we can certainly expect more cooperation in the advanced cases of chronic ulcerative colitis.

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Modern Operative Technics

No. 9

SURGICAL RELEASE OF CONTRACTED TISSUES FOR RESISTANT CONGENITAL CLUBFEET

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IT is well known that certain cases of congenital clubfeet are more resistant to treatment than others and that correction is almost impossible to obtain and maintain in these. Congenital clubfeet will respond to early adequate conservative measures in 90 to 95 per cent. Garceau in a representative series reported that 6.7 per cent of 1,275 patients required some operative procedure. The reason for this resistance is unknown. It has been variously attributed to delay in treatment, imperfect nerve supply to the muscles, failure to obtain and maintain complete overcorrection of the deformity and an imbalance between the invertors and evertors of the foot. We are concerned with these resistant cases in which the astragalus, scaphoid and os calcis have remained in abnormal relations in spite of treatment.

Rationale. The pathologic anatomy of congenital clubfoot is well known. It is not so generally appreciated that the relations which the bones of the foot occupy in this deformity are only an exaggeration of the position which they take up when a normal foot is put into the most extreme position of equinovarus of which it is capable. The astragalus is plantar flexed. The anterior portion of the os calcis is displaced inward and downward beneath the head of the astragalus; the scaphoid is displaced downward and inward so that it may touch the sustentaculum tali or the internal malleolus. There is an associated failure of development or contracture of the plantar muscles, the tibialis posterior and the ligaments on the medial side of the foot between the astragalus, calcaneum and scaphoid. The bony structure itself is usually normal in the early stages but the positions of the bones are altered as noted previously. Treatment then should be directed to the restoration and maintenance of the normal position.

Indications. It is the consensus that bony procedures are indicated for recurrent or resistant clubfoot when the foot is large enough. Bone development under the age of nine or ten precludes any direct attack on it. It would seem that any child with resistant or recurrent congenital clubfoot who has had two or more years of consecutive adequate conservative therapy and is under nine years of age is a logical candidate for a medial stripping procedure. Various soft tissue procedures and tendon transplantations have been described previously by Phelps, Ober, Elmslie, Brockman, Garceau and McCauley. The medial stripping procedure was performed by one of us (L. C. W.) for resistant clubfoot first in 1942.

TECHNIC

A straight incision is placed on the medial part of the foot starting behind the medial malleolus and crossing its lower portion, running obliquely forward to just distal to the cuneiform first metatarsal joint. The anterior tibial and posterior tibial tendons are identified. The anterior is retracted dorsally and medially. It is left attached to the first metatarsal but it is necessary to free it from its insertion on the medial cuneiform to expose the cuneiform metatarsal joint. The posterior tibial tendon is consistently found to be extremely tight and is thought to be one of the chief deforming factors. It is sectioned as high as possible and the distal portion excised. (Fig. 1.) The inferior calcaneoscaphoid ligament and the ligaments between the navicular and first cuneiform and first cuneiform and first metatarsal joints and all tight bands on the medial border of the foot are excised with sharp dissection. (Fig. 2.)

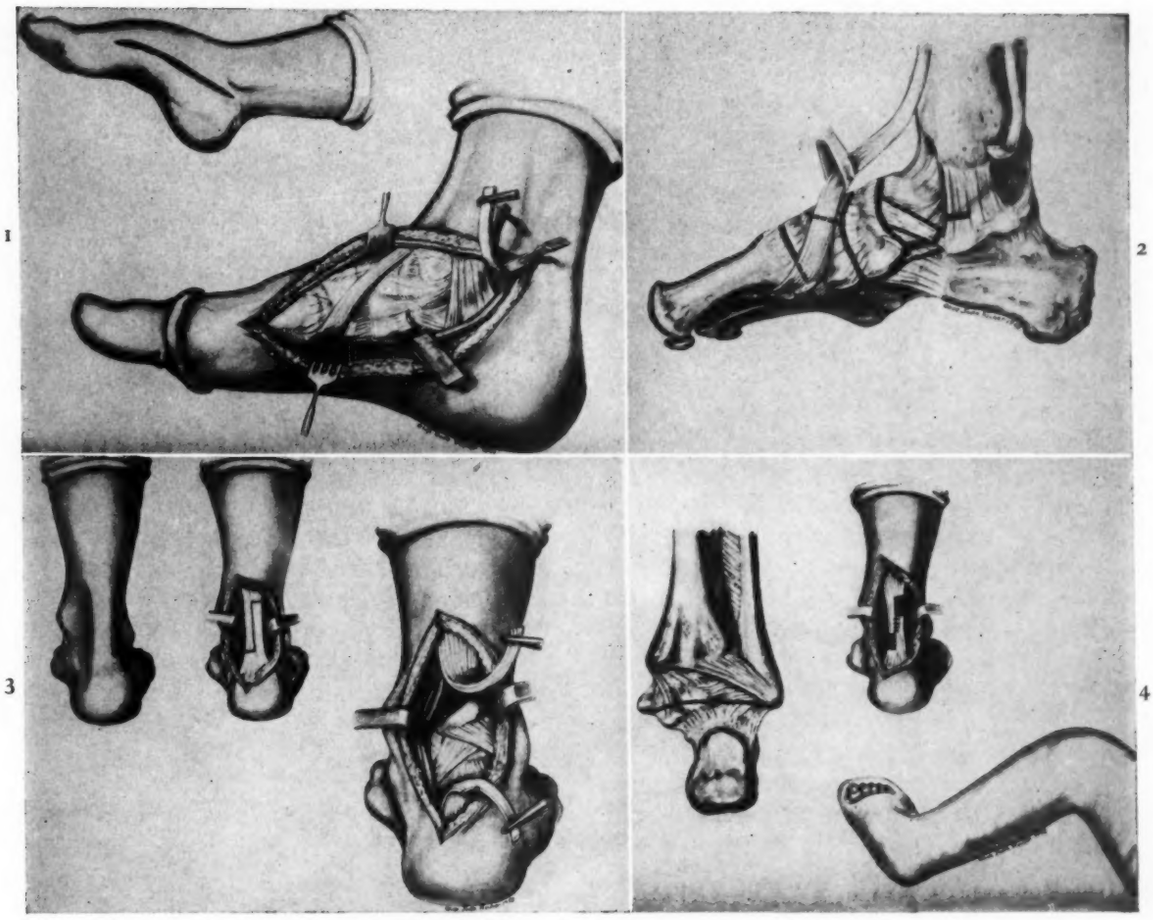


FIG. 1. Drawing of normal foot showing incision and structure on medial side of foot; the posterior tibial tendon has been sectioned.

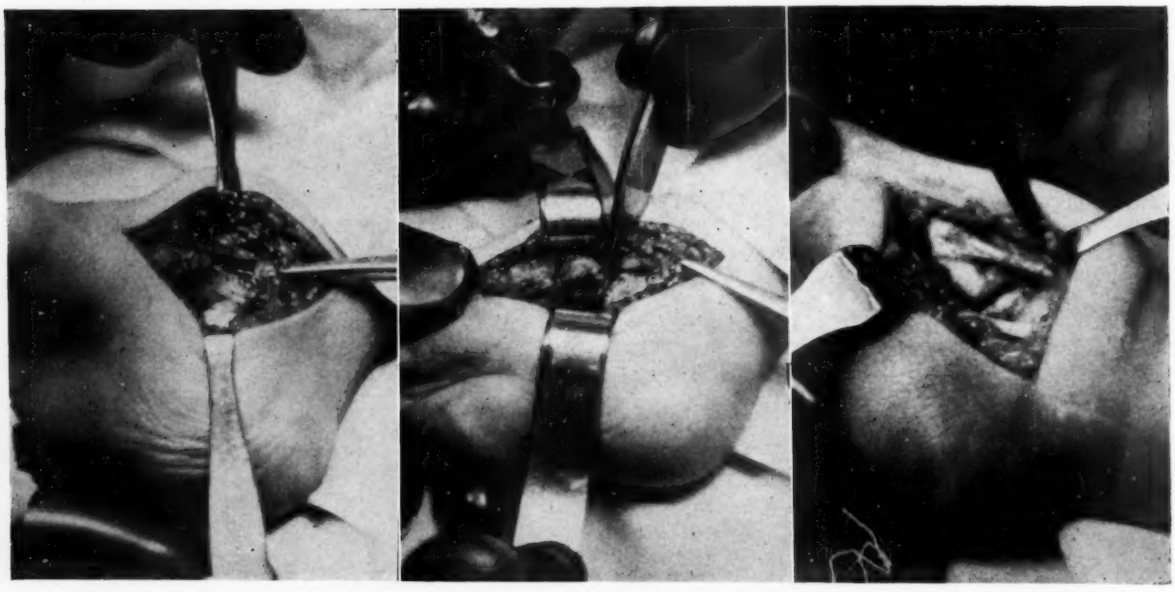
FIG. 2. Drawing of normal ligamentous structure; the lines indicate the ligaments to be excised.

FIG. 3. The posterior incision; division of the heel cord and exposure of the posterior capsule and ligaments of the ankle and subastragaloid joint.

FIG. 4. Section of the posterior capsule; repair of the heel cord with foot in corrected position. The plaster is carried above the knee after both stages.

Tight structures on the dorsum of the foot are freed with a periosteal elevator. The attachment of the anterior and middle portions of the deltoid ligament to the os calcis is stripped subperiosteally. The periosteal elevator is carried across beneath the foot to the region of the cuboid. It is sometimes necessary to section a portion of the dorsal astragaloscaphoid ligaments and the interosseous ligaments between the os calcis and talus. The attachment of the plantar fascia to the os calcis may be sectioned. The foot is then manipulated into a position of abduction and valgus bringing the scaphoid around in front of the astragalus. If a prominent beak remains on the scaphoid, it may be removed with an osteotome. No attempt is made to obtain complete correction of the varus adduction or the equinus deformity. The wound is closed without tension on the skin and a plaster cylinder applied from toes to groin with the knees flexed at 135 degrees.

Ten to fourteen days later a window is made in the plaster cylinder and the sutures removed. Approximately three weeks after the initial procedure lengthening of the Achilles tendon and posterior capsulotomy of the ankle and subastragalar joint are carried out. An incision is made along the medial border of the heel cord and is divided with a Z type incision. (Fig. 3.) The tibial muscles and nerves and the tendon of the flexor hallicus longus are identified and retracted medially. A transverse inci-



5 6 7

FIG. 5. Photograph showing scaphoid approximating the medial malleolus to which the clamp is pointing.

FIG. 6. After release of the contracted soft tissues the scaphoid can be brought around the head of the astragalus into the normal position.

FIG. 7. The anterior tibial tendon is tight and prevents complete correction of the anterior foot adduction in this instance.

sion is made through the capsule of the ankle and subastragalar joint. The tissues are stripped well forward from the medial side of the os calcis with a periosteal elevator. It is then possible to manipulate the foot into a position of dorsiflexion, abduction and valgus. Holding the foot just above a right angle, the heel cord is sutured. (Fig. 4.) The foot is placed in a position of mild overcorrection and a long leg plaster applied with the knee flexed (Figs. 5 to 7.)

Three to four weeks after the second stage a short plaster walking boot is applied with a flat walker on the sole. This is applied with the foot in only mild overcorrection and maintained for six months following the initial procedure. It is renewed at intervals as necessary. When the plaster is removed, a $\frac{3}{16}$ inch wedge is placed on the outer border of the soles and heels and all activities encouraged. A striking amount of flexibility is present in the foot immediately after removing the plaster. (Figs. 8 and 9.)

RESULTS

A total of thirty-six patients have had treatment by this method. Of these, six cases are too recent for evaluation, six have been lost and twenty-five have been followed up over one year. These cases have been classified as follows: (1) Excellent: foot flexible, symptom-free, complete correction clinically and by x-ray of the equinovarus adduction deformity; (2) good: foot flexible, symptom-free, complete correction of varus and equinus but still residual forefoot adduction; (3) fair: symptom-free, improved clinically but mild residual deformity in all three components by x-ray; (4) poor: no improvement or recurrent deformity.

Twenty-five patients with thirty-eight medial stripping procedures have been followed up for over one year. The average age was 4.9; the youngest was two and a half and the oldest eight. Ten of these cases have been graded as excellent, seven as good, sixteen as fair and five as poor; 87 per cent were definitely improved. The longest follow-up was six years, the shortest one year. Changes have been seen in the bony structure of five of these patients, three of whom had had forced manipulations under anesthesia prior to medial strippings. In three cases rotation osteotomies of the tibia were required because of internal tibial torsion. One was done prior to medial stripping and two subsequent to it. The five feet that were classified as poor occurred in three patients, one with

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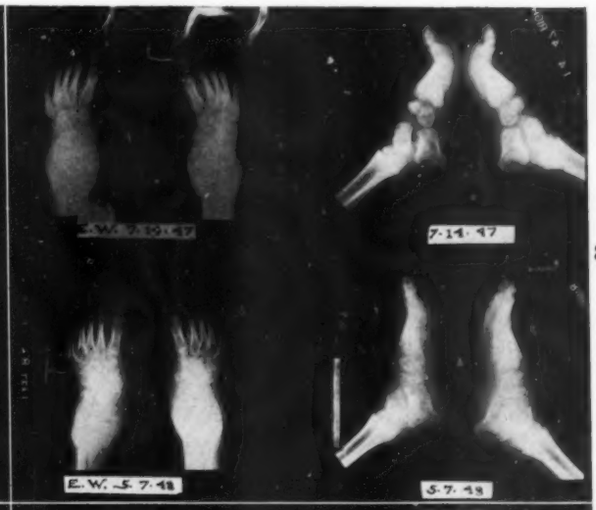

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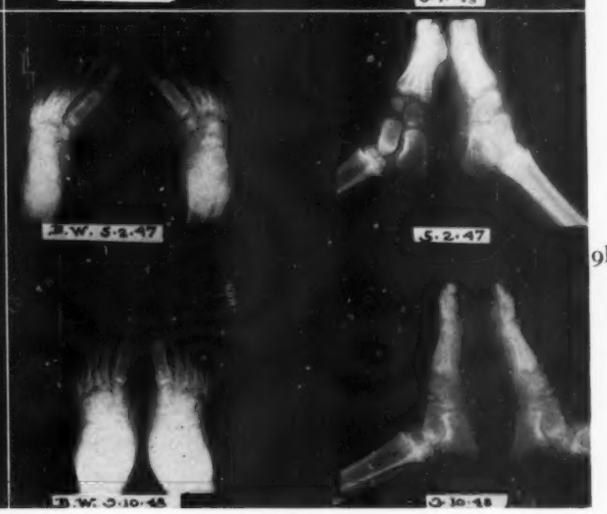

FIG. 8. A, patient E. W., a six and a half year old girl with bilateral resistant clubfeet. The upper photographs are immediately preoperative; the lower ten months later. She has been followed up three years without recurrence. B, the roentgenograms show the varus adduction deformity and complete correction obtained.

FIG. 9. A, patient B. W., age four. Photographs before and nine months after operation; there has been no change in three years. B, roentgenograms show marked varus adduction deformity with good correction.

arthrogryposis multiplex congenita and another with multiple congenital abnormalities. The third patient with one foot rated as poor had a slough following the initial procedure and had subsequent fibrosis in the foot.

COMMENTS

All these patients had adequate trial of conservative therapy prior to operation. Those who had forcible manipulations under anesthesia prior to the time of the medial stripping procedure showed less flexibility postoperatively. Excluding the cases rated as poor, all patients have good weight-bearing feet, have been free of callouses and pain and have been able to wear ordinary shoes. Contracture of the anterior tibial tendon may play a part in the rather high percentage of residual forefoot adduction. In two cases recently the anterior tibial tendon prevented forefoot correction and it was transplanted to the dorsum of the medial cuneiform. The posterior tibial tendon is always extremely tight and is one of the chief deforming influences. There has been no change in the atrophy of the calf or shortening of the foot and extremity. None of the patients has had active power in inversion of the foot. Most are able to stand on their toes. In no instance has it been possible to restore the foot to an entirely normal appearance.

SUMMARY

1. A soft tissue procedure has been described for recurrent or resistant congenital clubfoot.

2. Twenty-five patients with thirty-eight medial stripping procedures have been presented (ten excellent, seven good, sixteen fair and five poor); 87 per cent had good functional results.

3. Medial stripping when properly done is not unduly traumatic. Most of the feet have been moderately pliable one year postoperatively.

4. A child who has had two or more years of adequate conservative therapy for resistant or recurrent congenital clubfoot without correction and whose bony development precludes bone procedures is a logical candidate for medial stripping procedure.

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Streamlined Articles

TECHNIC FOR THE SUTURE OF THE EXTENSOR MECHANISM OF THE KNEE

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A TECHNIC which has been found to be very useful and which obviates some of the disadvantages previously encountered in suture of the extension mechanism of the knee has been used for fractures of the patella requiring excision of the distal fragment, for patellectomy repair and for the repair of rupture of the patellar ligament. This method consists of the use of a doubled wire suture combined with a pull-out wire, and as far as known has not been described previously.

* * * *

Dunn[2] in 1934 reported the use of phosphor bronze wire for rupture of a patellar tendon. The wire was passed transversely through the patellar tendon and then by means of separate needles down the borders of the patella through the skin and was tied over a pad of gauze below the patella. This could be removed later with ease. Continuous traction in Thomas' or Braun's splint with the traction applied to the ends of a wire suture was reported by Dunn in 1937.[3] The suture was placed through the upper pole of the patella or just above it. Key[5] in 1946 described a technic in which separate stainless steel wire sutures were passed distally on each side of the patella and withdrawn later by separate pull-out wires. The anchoring sutures were tied over wooden cross bars.

Preoperative Considerations. Preoperative aspiration is frequently a necessity for fractures. Convalescence is definitely prolonged by delay. Therefore, if the skin is intact and infection is not present, operation should be performed within the first few days. This applies to fractures and tendon ruptures.

TECHNIC

The patient is placed in a supine position on the operating table. A pneumatic tourniquet is desirable and may be used during part of the procedure unless contraindicated. A small sandbag sufficiently large so that the knee in an extended position clears the table a little is placed under the ankle region. This is a very important feature upon which depends the success of the procedure. After preparation and draping of the operative field an incision for adequate exposure is made. A U-shaped incision is preferable for fractures with wide tearing of the lateral expansions. For patellectomy repair or suture of the patellar ligament a parapatellar incision provides adequate exposure. If a U-shaped incision is used, a fluffed gauze sponge placed loosely under the reflected proximal flap will enhance viability. Vascular supply will not be compromised by sharp angling at the base of the flap.

Shreds of tissue from the margins of the tear, excess blood in the joint and clots extending throughout into the medial and lateral margins of the tear are removed.

The distal fragment is excised. Whether excision of a large distal fragment—up to half the length of the patella—is preferable or not depends upon the extent of damage. (Fig. 1.) Failure to obtain good approximation of apposing cartilaginous surfaces, the presence of larger defects or irregularities in the cartilage and comminution are indications for excision. Otherwise, fixation of the proximal and distal fragments by any of the accepted methods would be preferable.

The fracture surface of the proximal fragment is trimmed and smoothed so that the line of cleavage is approximately transverse. Underlying cartilage should be normal for proper gliding. A moist gauze sponge placed just beneath the fragment during the procedure will prevent entrance of particles into the joint. It is advisable to round off the distal anterior

FIG. 1. Fracture with wide separation of proximal and smaller distal fragment indicating a tear extending into the quadriceps expansions. The pull-out wire technic of suture is particularly suitable for this type.

sharp margin somewhat to avoid subsequent pressure against the skin.

A No. 30 stainless steel wire is doubled so that the length is about 20 inches. One end of the doubled wire is passed through a long, narrow, three-eighths circle cutting-edge needle. A 3¼ or 3½ inch King type of needle is satisfactory.

Beginning at the mid-point of the quadriceps tendon adjacent to the upper pole of the patella the doubled wire suture is passed transversely through the tendon to emerge short of the margin, medial or lateral. The needle is reinserted practically at the site of previous emergence and is passed downward beneath the superficial layers of the aponeurosis as close as possible to the border of the patella to emerge adjacent to the fracture surface of the proximal fragment. (Fig. 2.) Entry into the suprapatellar pouch or joint should be avoided. The suture is next passed distally through the patellar ligament between the border and the midline to emerge proximal to the insertion, and then subcutaneously to emerge through the skin just below and to one side of the anterior tibial tuberosity. The other end of the doubled wire suture is placed through the quadriceps tendon like that of the opposite side. A pull-out wire of the same material about 1 foot long is passed around the base of the doubled suture. After

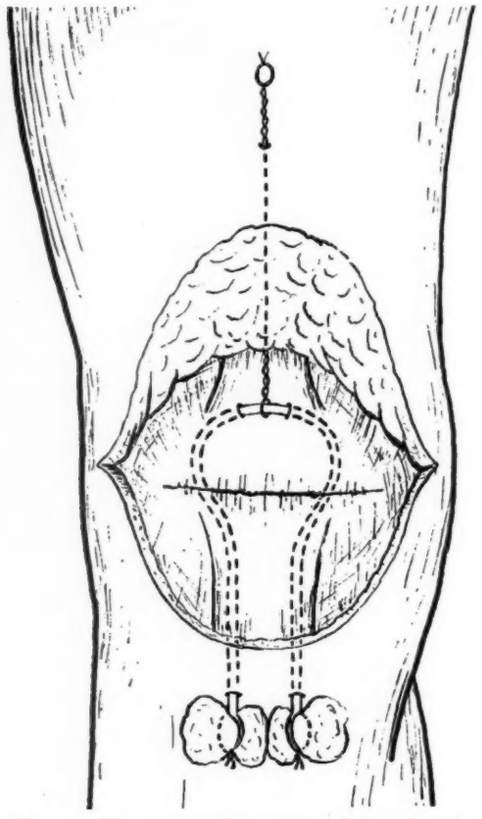

FIG. 2. Illustrates placement of the doubled anchoring suture beneath the superficial layers of the aponeurosis and patellar ligament to prevent interference with gliding of the extensor mechanism. The twisted pull-out wire is passed subcutaneously, then through the skin and the end is twisted into a loop to prevent wandering.

this the suture is passed downward in the same manner as on the opposite side. Some of the torn synovium and capsule can be repaired at this stage. Traction is placed on the ends of the wire sutures simultaneously and each pair is tied over a separate bolster while the tension is maintained. A gauze thumb-sponge serves this purpose well because sufficient resiliency is provided to prevent undue pressure against the skin. At this point it should be emphasized that the sole purpose of using a doubled wire is to prevent necrosis. Two wires which are passed through the skin by way of a single opening

obviously will not have intervening skin between them.

The lateral expansions can be easily repaired in good apposition with lighter suture material (absorbable or non-absorbable) than would be otherwise possible because tension at the suture line is eliminated. For example, interrupted chromic catgut suture (No. 00) or equivalent silk or cotton is usually satisfactory.

In patellectomy repair an allowance for overlap must be made when the wire sutures are placed in. Also, the suture should be placed in the quadriceps tendon at a higher level. For a good result all the slack must be taken up at the line of suture while the knee is in a well extended position.

Mild traction is made proximally on the ends of the pull-out wire to form a small snug loop around the base of the anchoring suture. Entwining the wire, as suggested by Bunnel,[1] will prevent tissue from growing in between the wires. The end of the twisted wire is threaded through the same type of needle as previously used and is passed subcutaneously to emerge about 4 inches proximal to the upper pole of the patella. (Fig. 2.)

With the knee in extension sterile dressings, sterile sheet wadding and a plaster are applied. A dressing placed under the loop of the pull-out wire prevents irritation from the wire ends. The plaster is bivalved preferably and held together with elastic bandages. However, if the anterior half is more lightly constructed, the plaster may be cut down one side only so that spreading to accommodate swelling is easily accomplished. Patients are more comfortable in a plaster extending from the upper thigh to the necks of the metatarsal bones than in a plaster cylinder.

POSTOPERATIVE MANAGEMENT

High elevation of the extremity for the first twenty-four hours, followed with less elevation for the next day or two, usually is sufficient to relieve reactive swelling and effusion.

Pain determines the time when quadriceps setting exercises can be started; this varies in patients. Most patients can begin about the second or third postoperative day, and straight leg raising with passive aid at first may be started about two or three days later.

On the twelfth postoperative day the anterior half of the plaster is discarded and the skin sutures are removed. Dressings over the wire suture and pull-out wire are left in place and elastic bandages are applied to the extremity extending from just back of the metatarsophalangeal joints to the upper thigh. Flexion and extension exercises with resistance to extension are performed several times a day. Flexion of about 30 degrees does not produce discomfort, but beyond that patients have complained of a stretching sensation and tightness. In between periods of exercise the posterior half of the plaster modified into a posterior half cylinder may be used for a few days.

Weight bearing without support is developed as rapidly as possible. Some weight bearing with crutches is permitted the twelfth postoperative day and is gradually increased.

The doubled wire anchoring suture is removed on the nineteenth to the twenty-first day. Equally as good results have been noted when the suture was removed on the nineteenth day as later on. How early the suture can be removed with safety has not been determined. In animal experimental work on tenorrhaphy Garlock[4] found the retention apparatus could be safely removed on the eighteenth day. To remove the suture the distal ends are cut proximal to the bolsters and the suture is then withdrawn by pulling on the pull-out wire. At this time there is sufficient slack so that the suture can be drawn out and cut through a part which has been lying within the skin.

After removal of the suture the patient continues on a course of active exercises to increase flexion of the knee and quadriceps resistance exercises. In the absence of initial complications flexion is relatively rapidly regained except the terminal 15 or 20 degrees which are more gradually regained. Satisfactory function (good flexion and quadriceps strength, complete extension, stability, completely unsupported weight bearing) is attained after two to three weeks of rehabilitation following removal of the suture. For average occupational demands a residual mild weakness of mild limitation of flexion is not a serious handicap; with function and exercise there will be progressive improvement.

COMMENT

In fracture of the patella with comminution of as much as the distal half it is of primary importance to reduce convalescence and duration of disability. Time that would otherwise be lost in immobilization in plaster for up to six

weeks is utilized to rehabilitate the patient. The length of immobilization in plaster is approximately halved because the technic of suture permits healing without the danger of separation during the critical period. Restricted use of the knee is possible after the second week and may lead to a rapid increase of the tensile strength at the line of union, such as occurs in other tendons. In experimental work on the rate of healing of tendons Mason and Allen[6] found that use of the tendon after fourteen days produced a rapid increase in the tensile strength at the line of union.

Not only frank separation but also excessive tension, tearing and stretching at the line of union are eliminated during healing. All of these cause slack or elongation to such an extent that complete extension of the knee becomes impossible. There is not only elongation but also instability. This is particularly true of patellectomies. It is not surprising that there often would be slack when the aponeurosis is relied upon. In poorly developed and older patients especially the weakness of the aponeurosis often is a most striking feature. Stretching from tension as well as early motion could easily produce elongation.

There is an additional useful feature. When there is extensive tearing of the lateral expansions with wide separation of fragments, a fascial graft or suture usually is not necessary. Although a fascial graft is indicated in certain cases, a more complex, time-consuming technic with a longer period of disability can frequently be avoided.

Operating time is not increased since the technic simply consists of placement of a removable suture. Considerably less time is required than if holes for sutures were drilled through the proximal fragment.

There is some danger of infection just as there is wherever the pull-out wire technic is used as, for example, in the hand. This is minimized; present methods of prophylaxis (meticulous asepsis, prophylactic chemotherapy) make the possibility of infection rather remote. To avoid infection further it is best not to disturb the dressings over the wires unless there is a definite indication for inspection. The technic itself tends to minimize the possibility because, as described previously, the anchoring suture and pull-out wire are brought out through the skin at a distance from the site of repair.

The element of infection raises the question whether internal fixation with a wire suture without a pull-out wire would not be the procedure of choice. However, even with a pull-out wire technic, as previously mentioned, patients complain of pain on flexion beyond 30 degrees. To overcome the rigidity of wire fixation there would have to be stretching of the quadriceps, or the wire would break or cut through the tendinous structures. A return of desirable flexion would be delayed and duration of disability prolonged.

Certain fractures, of course, should not be treated by the method described. Among these are marginal, chip and small polar fractures as well as all those that can be treated conservatively.

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THORACICOABDOMINAL APPROACH TO THE COMMON BILE DUCT

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A CASE is presented herein of obstructive jaundice resulting from adhesions constricting the hepatic ducts secondary to four previous operations in the region of the biliary tract. The thoracicoabdominal approach remarkably facilitated the surgical release of the adhesions. The patient suddenly expired one month postoperatively from the rare occurrence of spontaneous rupture of the aortic valve. The patency of the extrahepatic biliary ducts was demonstrated at autopsy. The right transthoracic thoracicoabdominal approach appears clearly indicated for certain difficult problems of reconstructive biliary tract surgery as demonstrated by the case reported herein.

* * * *

Exploration of the common bile duct following previous biliary tract surgery is generally regarded as among the most difficult of surgical procedures. By way of the usual abdominal route the surgeon is compelled to work his way through many thick and often inextricable adhesions; this of necessity proves both time-consuming and hazardous.[1,2] Moreover, in separating the duodenum from the liver, troublesome accessory biliary fistulas are not uncommonly encountered; the general peritoneal cavity is opened up to collections of serum, bile and purulent materials; and, in view of the attending handling of the bowel, postoperative ileus can be expected to be most severe. Finally, and of prime consideration, with the usual anterior abdominal approach the structures at the hilum of the liver are accessible only with difficulty if at all; one works deep in the abdominal cavity, and visibility and maneuverability are hampered by virtue of a fixed liver and an overhanging costal cage. Such limitations are of particular importance in reconstructive surgery of the biliary tract since most cases require dissection at or near the hilum of the liver together with T-tube drainage, choledochocholedocostomy or choledochoduodenostomy.[1,3-7] Often dissection of the common duct in the head of the pancreas is in order, requiring reflection and medial retraction of an adherent, anatomically distorted duodenum.[1,3,8] (Fig. 1.)

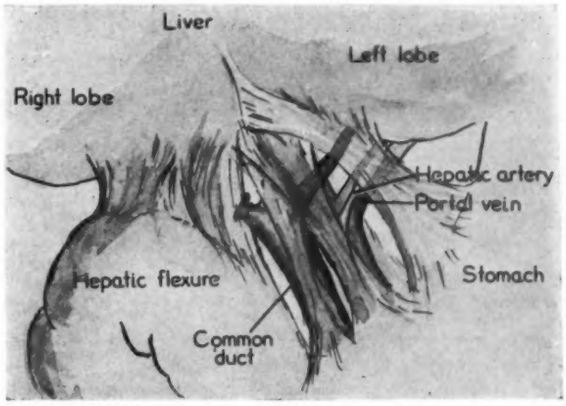

FIG. 1. Exposure of common duct through anterior approach showing marked adhesions and distortion of anatomy.

In 1948 and subsequently one of us (V.P.S.) described a right thoracicoabdominal approach for portacaval shunt and suggested its use for difficult cases of reparative common duct surgery.[9-11] It was observed at that time that when the diaphragm was divided and the liver dislocated into the right hemithorax, the common duct came clearly into view lying superficially, presenting its right lateral aspect, free of the adhesions which fixed its anterior surface to adjacent structures and delineable throughout its entire length. It was noted, too, that with gentle traction on the duodenum the head of the pancreas is visualized from behind and dissection of the distal portion of the duct is simplified. (Fig. 2.)

Since the original description of the right thoracicoabdominal approach a description of its employment for common duct surgery has not appeared in the literature. We therefore think it pertinent to report an instance in which its use was clearly indicated.

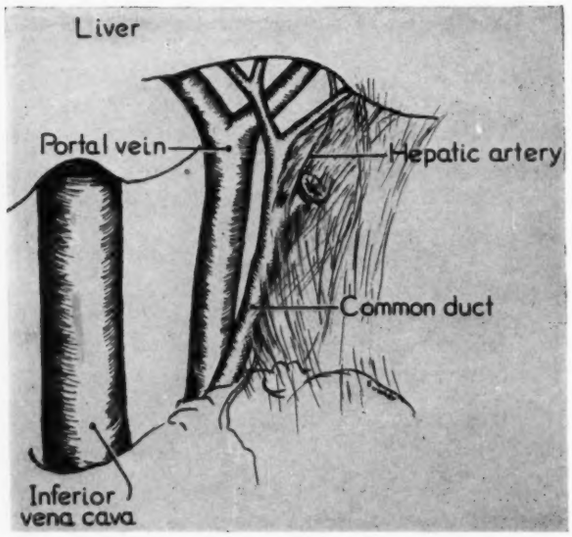

FIG. 2. Exposure of common duct through right thoracicoabdominal approach showing dense adhesions anteriorly. The duct presents its lateral aspect.

CASE REPORT

P. R., a sixty-seven year old white male, was admitted to Mount Sinai Hospital on April 3, 1950, complaining of recurrent right upper quadrant pain, vomiting, chills and fever, and constipation of two weeks' duration. Seven years previously the patient had been admitted to another hospital with acute cholecystitis; cholecystectomy and choledochotomy had been performed. At that time postoperative intestinal obstruction and wound evisceration developed, both of which required surgical intervention. The case was further complicated by the development of a duodenal fistula. Following preliminary jejunostomy the fistula was repaired surgically. Except for occasional bouts of chills, fever and jaundice, the patient had been in fairly good health following this series of four operations.

Physical examination on admission showed blood pressure 160/100, pulse 110 and temperature 102°F. There was slight icterus. The abdomen was mildly distended, soft but tender in the right upper quadrant; peristalsis was hypoactive. No masses were palpated. The remainder of the examination was negative except for slight cardiac enlargement to the left. Urine was brownish but otherwise negative. Hemoglobin was 13.9 gm. (89 per cent) and white blood cells 11,300 with 81 per cent polymorphonuclears. Other laboratory studies were as follows: serum amylase 405 mg., lipase 0.6 mg., phosphorus 2.1 mg., blood urea nitrogen 13 mg., blood sugar 116 mg., plasma chlorides 560 mg., prothrombin time 92 per cent, total proteins 6.6 gm. (albumin 3.2 gm., globulin 3.4 gm.), icterus index 19, cephalin flocculation +2, thymol turbidity 5 units, thymol flocculation 0, and alkaline phosphatase 7.0 K.R.

An electrocardiogram showed only slurring of the QRS complex. Chest x-ray demonstrated enlargement of the heart in its transverse diameter. Scout film of the abdomen showed isolated loops of gas-filled, non-distended small bowel. It was thought that the patient had recurrent obstruction of the common bile duct due to stone or stricture.

During the first week in the hospital the icterus became more marked, stools were clay-colored and urine darker. The icterus index rose to 26 and serum bilirubin to 4.5 mg. Exploration of the common bile duct seemed indicated and this was carried out on April 14th.

With the patient on his left side and the gallbladder rest elevating the left costal margin, a long incision was made in the eighth interspace from the spinous process through the costal cartilage and right rectus muscle. The ribs were spread. The right leaf of the diaphragm was divided exposing the superior surface of the right lobe of the liver where numerous adhesions due to previous surgery were present. These adhesions were separated and the liver retracted into the chest exposing its inferior surface. Anteriorly there were many adhesions which unquestionably would have made exposure of the common duct through the anterior approach extremely difficult and hazardous. The transverse colon was plastered up against the inferior surface of the liver. Posteriorly the area was clean and the common duct easily accessible. The common duct was exposed by careful dissection and was separated from the portal vein. Proximal dissection revealed obstruction of the duct close to the hilum of the liver due to constricting adhesions. The common duct was opened and probes were passed distally into the duodenum with ease but could not be passed proximally beyond the stricture. The constricting adhesions were divided and bile was now seen to flow from the proximal end of the duct. No calculi were present. A T-tube was inserted into the duct and the opening in the duct closed

over the tube with interrupted fine chromic sutures. A cigarette drain was placed at the operative site, and tube and drain were brought out through the anterior margin of the incision. The diaphragm, cartilage, muscles and fascia were approximated with chromic catgut suture; the chest was closed with water-sealed drainage; the skin was closed with continuous black silk suture.

It is noteworthy that during the course of the operation traction on the liver caused a drop in blood pressure which returned to normal when the traction was released.

Postoperatively the patient did well except for transient basal atelectasis. Bile drained through the T-tube and the jaundice subsided. Cholangiogram on May 16th showed dye flowing readily into the duodenum. On May 18th the patient began to experience attacks of chills and fever, and on May 21st he suddenly became dyspneic, intensely cyanotic and expired.

At autopsy the extrahepatic ducts were found to be entirely patent and contained no calculi. The structures overlying the common duct were markedly adherent, clearly demonstrating that exposure by the anterior approach would have been extremely difficult. Other findings were insignificant except for the rare condition which was found to be the cause of death: unexplained spontaneous rupture of the aortic valve.

COMMENTS

It is quite possible that many cases labeled "inoperable intrahepatic obstruction" might be amenable to surgical attack by use of transthoracic thoracicoabdominal approach in lieu of the commonly used abdominal route. Certainly reconstructive biliary tract surgery is rendered remarkably simpler by this approach. In the case reported bands of adhesions constricting the hepatic ducts close to their origins were easily separated, with relief of jaundice; the postoperative patency of the biliary ducts was demonstrated at autopsy. It would seem reasonable, too, to expect greater success with the transthoracic approach in attacking the difficult problem of exploring for calculi high in the hepatic ducts.

The many advantages of the transthoracic thoracicoabdominal approach have been previously enumerated.[9,10] For use in biliary tract surgery these may be listed as follows: (1) Exposure is wide because of the free spread of the ribs and the free communication of the chest and abdominal cavities. (2) The hilum of the liver is presented more superficially than when the patient is placed on his back. (3) The structures in the hepatogastric omentum are approached from the lateral aspect thereby presenting a fresh, relatively unadhesed surface of the common duct for choledochostomy or, if necessary, a readily accessible point of departure for more extensive common duct dissection. (4) The approach to the hilum of the liver is direct since the incision is carried precisely over its anatomic location. Hilar accessibility is further enhanced by virtue of the fact that (5) the liver can be dislocated into the right hemithorax; the diaphragm no longer restricts mobilization of the liver as it does in the abdominal approach. (6) The hepatic ducts can be easily exposed up to their very points of origin. (7) It is unnecessary to separate adhesions fixing the liver, duodenum and hepatoduodenal ligament to the anterior abdominal wall. The adherent structures are left unmolested lying to the right side of the "new exposure." This indeed serves to advantage inasmuch as (8) the general peritoneal cavity is not opened up to collections of serum, bile or pus. (9) Handling of the intestines is avoided thereby reducing to a minimum postoperative ileus. (10) Little chance for postoperative incisional hernia exists since the abdominal portion of the wound constitutes a small part of the entire incision. (11) Operative time is significantly reduced.

Since this is the first time, as far as we have been able to establish from the literature, that the transthoracic thoracicoabdominal approach has been employed for biliary tract surgery, the authors recommend its wider usage in those cases in which previous surgery would undoubtedly render mobilization of the common duct or its remnants most difficult. Although entering the chest is apparently more time-consuming and would seem to favor morbidity, actually the avoidance of common duct mobilization saves considerable total operative time, and morbidity is in consequence reduced, at least that component due to prolonged anesthesia, handling of tissue, surgical trauma and exposure. Today, with modern supportive measures, thoracotomy adds little to whatever morbidity might be due to laparotomy.

Acknowledgment: The authors are indebted to Dr. Sidney Zubrow for the medical management of this case.

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Schmitz reviewed almost 200 cases of primary cancer of the cervical portion of the uterus in which patients were treated with radium and x-ray. The five-year survival rate was about 40 per cent since using the 800 kv. machine. Tumors that proved non-radiosensitive were treated with surgical extirpation when this was possible. Often a more or less complete pelvic evisceration has to be performed, as recommended by Brunschwig. (*Richard A. Leonardo, M.D.*)

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CERTAIN ASPECTS OF GYNECOLOGIC PRACTICE IN THE LATE NINETEENTH CENTURY*

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WHEN Dr. C. Jeff Miller died in 1936, gynecology had become a firmly established specialty. On the other hand, a number of the procedures and agents which we now take for granted were either just coming into general use or were still entirely unknown. Constant intestinal decompression and the precise maintenance of the fluid and electrolyte balance had only recently become a standard part of the surgical routine; formerly they had been measures reserved for seriously ill patients. By 1936 transfusion had ceased to be, in effect, an antemortem procedure, though the use of whole blood in liberal amounts, which is now a routine practice, was then not even contemplated. Proteins for intravenous use were still to be introduced. Early ambulation had not yet been revived. Non-absorbable suture material was not yet in general use. Ligation of the vena cava in the management of thrombosis was entirely unknown. Dr. Miller, who did some of the pioneer work on ligation of the pelvic veins for pyemia, would have been interested in its development by one of his own students and one of his successors in the Chair of Gynecology at Tulane, Dr. Conrad Collins. Finally, when Dr. Miller died, the first clinical reports on the sulfonamide drugs were still to appear and most of the antibiotics had not yet been discovered.

The advances which I have mentioned have simplified the practice of gynecology and improved its morbidity and mortality. They have also definitely reduced the necessity for surgery in pelvic infections. I think it important to emphasize, however, that they have not in any way altered the principles of gynecologic surgery which Dr. Miller, himself, did so much to establish. In these days of widespread and uninhibited use of chemotherapeutic and antibiotic agents it is well for all of us to keep that fact in mind.

Dr. Jeff Miller entered the Medical Department of the University of Tennessee in 1892, when he was eighteen years old. He was graduated from it two years later after ten months of formal medical training along with the other 113 students who had entered with him. His span of medical practice covered, as I have already intimated, the years in which gynecology was becoming a firmly established specialty. During these years he rose from a fledgling assistant in the Tulane University School of Medicine to head of the Department of Gynecology. During these same years he was at various times President of the Southern Surgical Association, the Southeastern Surgical Congress, the American College of Surgeons and the American Gynecological Society.

I thought it might be of interest if I devoted this writing to some account of the specialty of gynecology as it was when Dr. Miller first began to practice medicine. For this information I could think of nothing more authoritative than the Transactions of the American Gynecological Society. I recommend them as a treasury of interesting material.

The American Gynecological Society was founded in 1875, its founding, as one of its earliest presidents remarked, giving evidence "of the keen interest felt by the entire medical profession in all that relates to the dearest members of society." The subjects with which the Society occupied itself in its first years may

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fairly be regarded as those with which all gynecologists were concerned and the medical practices which were discussed may fairly be regarded as those which the young medical student was taught. I propose to relate some of them and you will probably wonder, as I do, how, being taught so much that was absolutely wrong in the light of later knowledge, Dr. Miller became a gynecologist of such competence and ability.

During the first twenty years of its existence the American Gynecological Society occupied itself again and again with subjects which are still of predominant interest to gynecologists of today: fibroids of the uterus; cancer of the cervix; ectopic pregnancy; and pelvic inflammatory disease, which then most of them called pelvic cellulitis and about which most of them held almost completely wrong notions. Other conditions which were discussed at length have lost much of their interest for modern gynecologists. Displacements of the uterus are now properly regarded as of very little surgical importance and diseases of the ovary, except for tumors, are now recognized as endocrine rather than surgical problems.

Much that is in these Transactions, as I have said, is entirely out of date. Much of it has a quaint and curious sound to modern ears. I think I should say that I have deliberately, even when what I am saying is not enclosed in quotation marks, used the language of the Transactions. It has a flavor of its own and it echoes the character of the age. But the thing I really want to emphasize before I begin my story is that these men practiced according to the lights of the time, they did the best they could with the resources and the knowledge then available and they had, most of them, a sincerity in the profession, an interest in their patients and a devotion to their vocation which all of us might well emulate in this more casual and, I am afraid, more callous age.

SURGERY OF THE OVARIES

When the American Gynecological Society was founded, the surgical removal of ovarian tumors was already established after, however, a very stormy history. You will recall that Robert Houston of Glasgow in 1701 probably attacked and destroyed a cystic tumor of the ovary through an abdominal incision, the patient living for thirteen years afterward, but his performance was entirely accidental. Ovarian surgery really began in 1809 with Ephraim McDowell's operation on Mrs. Jane Todd Crawford, by which act he put both her life and his professional reputation in jeopardy. The operation was a brilliant success and the patient was a brilliant example of early ambulation. You may remember that when Dr. McDowell visited her on the fifth day, Mrs. Crawford was up and making her own bed.

One would have thought that this success would have been enough to convince the most skeptical but it did not. When McDowell tried to publish the report of this case and of two other successful cases, Physick, who became known as the Father of American Surgery, would have none of his works; when the cases were later published, they attracted so little attention that when Nathan Smith performed the same operation in 1821, he thought that he was blazing a trail. For the next forty odd years the operation was variously described as "unjustifiable" and "murderous," and as outraging "fundamental principles of medical morality." It was considered unjustified even when it was successful; and when it was fatal, the prosecution of the surgeon for manslaughter was suggested. Entirely typical was the lecturer who opened his remarks, which were not on diseases of the ovary, by recounting "the sad history" of a "respectable lady" who went to Philadelphia for ovariotomy and returned to New York as a corpse. It is well that there were surgeons of the character of Washington Atlee. Both he and his brother were described by their confrères as butchers and murderers but Washington Atlee, who during his life performed 378 ovariotomies, said, "If, when relief can be afforded in a horrible and fatal disease, we are unwilling to hazard our fame or take responsibility in consequence of danger, then indeed we prostitute a high and holy office, fail to exercise it purely, and will have to give an account of it hereafter."

It seems extraordinary in view of these attacks that the utterly barbarous operation of "extirpation of the functionally active ovaries for the remedy of otherwise incurable disease" should have been received with calmness. Battey, who had first proposed the operation in 1872, reported ten operations in 1876 in women ranging from twenty-four to thirty-five years of age. By 1877 he had done the operation seventeen times and knew of fifteen other oophorectomies for the same indications. By 1887 he had

done the operation fifty-four times and the Society was ready to discuss his "matured results." It must be admitted that today we no longer accomplish so much. One of Battey's patients, previously bedridden and taking huge doses of opiates, had "bounded like an India-rubber ball at once into a state of perfect health and comfort" once her ovaries were removed, and several others also "bounded" at once into comfort and health. In one less successful case the patient's general health was excellent, and she also would have liked to get up and "jump around" but was prevented by pain. Another estimable young woman was always bright and cheerful after operation and "ever trying to cultivate the grace of thankfulness."

Battey's indications for this dreadful operation were extremely elastic. His contributions contain a good deal of philosophy about the right to life, relief of suffering, the physician's earnest seeking after truth and wisdom and his tender sympathies with his patients. On the medical side the indications included, among many others, congenital absence of the uterus, fibroids with dangerous hemorrhage not susceptible to surgical removal (this was perhaps the soundest of his indications), certain incurable flexions of the uterus and pelvic deformity requiring cesarean section. The indications also included "menstro-mania," a mental condition usually following upon great nervous disturbance incident to the unhealthy performance of ovulation; the profound impression made upon the nervous system by the change of life was thought well calculated to restore the mental balance. Nor was Battey alone in his indications. In 1885 J. T. Johnson reported four cases of oophorectomy for "menstrual epilepsy" and mentioned three other cases in which he was contemplating the operation. One of these patients had suicidal tendencies and it took several men to hold her down. Another woman, thirty years of age, was also prepared for suicide and had no prospect of being better "until the change of life inaugurates those changes and brings the mysterious quiet to the sexual apparatus of the female which we are powerless to hasten by treatment or to fully understand."

It seems astonishing, as late as 1887, to find Howard Kelly reporting that he had done Battey's operation many times "with most happy results," although unlike Battey he demanded that the ovaries be diseased before he would remove them. In 1888 Thomas said that he very often, after he had removed one ovary, took out the second and remarked to the bystanders, "I can find no reason for removing this one." However, Kelly said that he never removed the second ovary unless it were also diseased. In justification of this position he called attention to Spencer Wells' statistics. Of 700 women in the childbearing age who survived operation (apparently out of 1,000), 117 later bore 228 children and there were only eight recurrences, with one death. And there were other voices raised in defense of gynecologic sanity. As early as 1885 Emmet thought that more harm than good had been done by Battey's operation though his solution was to limit the procedure to a few experienced men. In the same year Reamy said that ovaries were important in the female economy and should not be needlessly sacrificed. In 1886 in his presidential address the same observer said that many a "sinless ovary" was being sacrificed because of the very brilliance and facility of the operation, and its comparative immunity to life. Considering the "painful want of familiarity with its minor pathologic changes," he thought it "painfully suggestive of too much freedom with the ovary" to remove it when it could be cured by "patient recourse to diet, massage, electricity, vaginal irrigation, medication of the vaginal vault and surface, rest of mind and body" and similar measures. The operation might add years to female life, Reamy warned, but some day some statistician would compute the years of human life lost to the race by destruction of ovaries whose "structure yet bears many possibilities for population." In the ensuing discussion Battey generously granted that his operation had been performed too often; in fact, he had records of cases in which he had advised it and patients had recovered without it. Nontheless, he believed that he did God a service when he sacrificed ovaries "with vitiated function," and he did not require proof before operation that they were diseased.

The arguments pro and con continued until 1893 when, for the first time, a voice of real authority was heard. J. Whitridge Williams said very firmly that from the tubes and ovaries he had examined in Baltimore, he was able to say that a great many operations were done without any justification at all from the standpoint of pathology and that many ovaries

could have been saved by the treatment of simple puncture recently suggested by Polk. He could not agree that retention of the function of menstruation and ovulation was not important enough to justify the endurance of dysmenorrhea if necessary. Wathen followed in the same vein; he hoped that the remarks which Dr. Polk had made about puncture of the ovaries would have a good effect upon the profession. He himself, when ladies complained because he would not accede to their requests to remove their ovaries, was accustomed to justify his refusal by saying, "Madame, . . . when in a few years you want them back, I cannot return them."

Noble dissented from this point of view. It was too sweeping to say that the Battey operation should be performed only when gross disease of the ovaries was demonstrable. Chronic oophoritis, he said, was an intractable disease which rendered the life of the patient scarcely worth living. It was important to treat the general health and employ the "mind cure," but these measures were useful only after operation. Williams rose up again. What did chronic inflammation of the ovaries mean, he demanded. He had worked in a laboratory several hours a day for four or five years. He had seen no ovaries answering that description and he cited Winternitz's monograph to support his point of view. All that Noble could reply to this broadside was that he had written his paper from the clinical point of view. At any rate after 1893 not much more was heard of the Battey operation for the removal of normal ovaries.

The discussion of Battey's operation made clear why it did not seem to gynecologists of his day the barbarous procedure it seems to us. They had no idea of gynecologic physiology as we understand it. Thus Lee in 1883 said that the day had passed when a surgeon competent to perform ovariotomy at all would be deterred from resorting to it in properly selected cases merely because the patient chanced to be pregnant. Emmet in 1885 objected to the operation because dysmenorrhea was a neuralgic condition having nothing to do with the ovaries and tubes; the symptoms were frequently caused by anemia and he thought it a reflection on the skill of the gynecologist to remove ovaries for anemia. In 1887 W. A. Johnstone stated that if gynecologists wished "to have a clear idea of the true physiological position of the uterus, we must emancipate it from the thraldom of the ovary, in whose firm grasp for the last fifty years it has been securely held." In 1891, the year before Dr. Miller entered medical school, Jenks mentioned Coe's idea of the malarial element in ovarian pain, and T. A. Reamy observed with naïve surprise that in an experience with 166 operations he had noted that in every case in which both ovaries were removed, menstruation had ceased rather promptly. He thought this interesting, in view of the concept held by some of his confrères concerning the importance of the tubes and the lesser importance of the ovaries in the function of menstruation.

SURGERY OF UTERINE FIBROIDS

When the American Gynecological Society was founded, uterine fibroids were still being managed, for the most part, by medical measures, chiefly by the administration of ergot for the control of hemorrhage and the use of electricity by the Apostoli method. In 1884 Sutton reported a case in which he had given 105 consecutive injections of ergot. In 1886 Reamy stated that electricity was of more general value than any other therapeutic method and in 1891 Franklin H. Martin, later to become the moving spirit of the American College of Surgeons, said, rather contradictorily, that electricity had a limited application but could be used in 75 per cent of all fibroid tumors, which should never be touched by the knife. The discussion waxed very warm. Sutton remarked that this method, with which he had failed completely, was "an absolute piece of rot." Dr. Skene replied that the extreme heat might have caused Dr. Sutton to speak more warmly than he had intended; when he read back his remarks, perhaps he might want to take some of them back. Dr. Keith said that Dr. Skene had taken out of his mouth the words he intended to use in replying to Dr. Sutton.

Although the first myomectomy had been performed in 1844 and the first deliberate hysterectomy nine years later, extrauterine procedures such as ligation of the uterine arteries and bilateral oophorectomy were the preferred procedure at this time. Vaginal morcellation was still being practiced, often in numerous stages. The argument against surgery had several phases: Was operation needed at all? Was hysterectomy a justifiable procedure? If so, how should it be done, and,

in particular, how should the stump be managed? The latter, which is a purely technical consideration, I shall not touch upon except to say that it would be hard to think up anything which was not done with it. I also should remind you that there was at this time a complete misunderstanding of the pathologic process. Fibroids were not then considered incompatible with life, which is not always true, and it was widely believed then, just as it is sometimes still believed, that they atrophy after the menopause.

Be this as it may there was nothing calm about the reception of the idea of hysterectomy for uterine fibroids. In 1880 we find Palmer declaring that surgery for fibroids was really a crime unless the condition of the patient was critical. All the causes of death common in ovariotomy were to be expected, he said, in addition to greater difficulties with bleeding vessels and with the pedicle and the increased risk of the longer incision. In 1882 Goodell, discussing a contribution by Thornton, favored oophorectomy for fibroids. He had had two survivals in four operations, in one of them the results being so good that the twenty-nine year old patient was soon able to attend all the picnics in her part of the country. In the same year Gaillard Thomas, though he granted that the question was still open, thought that with the evidence now at hand of the value of oophorectomy for fibroids, he would hardly feel warranted in performing hysterectomy. It was his opinion that there was "no more dangerous gynecologist than he who goes forth determined to extirpate the uterus for solid tumors." Keith, the great ovariotomist, could "hardly imagine that any symptoms would justify the performance of a dangerous operation like hysterectomy for a mere fibroid." As late as 1886 H. P. C. Wilson was saying, "I shrink and have a feeling of terror come over me when I find myself obliged to do a hysterectomy." In 1891 Word said that he had never saved a patient with a large and dangerous fibroid by resorting to hysterectomy, and he had never seen anyone else save one either. Skene said that in New York the death rate for hysterectomy in fibroids was greater than the death rate for fibroids with or without any treatment. In 1893 Mundé was obliged to disagree completely with the view that every fibroid, when recognized, demanded removal of the uterus. In that case, he said, very few women of middle age would still possess a uterus. The Society should protest against "so much hysterectomy." Mann said that he had not yet got to the point of urging operation for every fibroid; it was his custom, when there were troublesome symptoms, to leave the decision for and against operation up to the patient. The following year Lusk devoted the president's address to the various methods of treating uterine fibroids and concluded that Polk's suggestion for the management of the stump, advanced in 1892, had brought about "the dawn of the new day when we could live at peace together," freed from this particular argument. In 1895 Emmet was warning that the abuse of hysterectomy was due to its ease of performance, a point which Dr. Miller, who himself performed the most dexterous hysterectomy I have ever seen done, was to make again and again throughout his professional life.

Incidentally, part of the discussion of hysterectomy had to do with whether or not the uterus should be left *in situ* after the adnexa were removed. In 1894 Wathen thought that if this practice were to be routine, the appendix should be removed too, since it was equally dangerous and just as useless, a remark which very clearly reveals the current status of appendectomy. In the same year Baldy thought that while the uterus should be left *in situ* if even a portion of an ovary could be saved, it ought to be removed under any other circumstances on the grounds that it could make trouble after the adnexa were removed, that the trouble could not be eliminated by extensive local treatment, and that its removal removed the fear of future malignancy. More than fifty years later these are still sound arguments.

PELVIC INFLAMMATORY DISEASE

The concept of pelvic inflammatory disease rather than of methods of managing it impresses the reader of the early Transactions of the American Gynecological Society. At the second meeting Noeggerath, in a discussion of latent gonorrhea with special reference to its influence on fertility in women, said that his previous presentation on the subject had been poorly received. Although much of what he said in 1877 would still be valid today, his remarks received another very poor reception. Dr. Barker said that while the speaker inspired respect as a conscientious and scrupulously

careful observer, he must anticipate that such views as he set forth in this paper, "so startling in the present state of the morals in society, will receive the most careful scrutiny." "If these views are true," Barker continued, "a modification of this paper should be found in every Sabbath-school library throughout the land." Dr. Trenholme of Montreal believed that on behalf of "half the continent" he must call for protection from such doctrines. If Canadian ladies thought that sterility was dependent upon the former condition of their husbands, he did not know what would take place. One member after another spoke in the same vein, their statements concluding with Johnson's remark that if the views expressed in this paper should be correct, "The mere instinct of man ought to restrain him from so brutal an act as becoming married to a pure woman when aware of the consequences." He had, himself, talked to twenty physicians all of whom had had gonorrhea in early life and all of whom now had healthy wives and large families. In his final remarks Noeggerath merely said that perhaps after the subject had been studied for another five years, the members of the Society might come to agree with him.

It took a good deal longer than five years for agreement. In 1889 twelve years later, we find Baldy saying that the gonococcus was merely the result of a gonorrheal infection, never the cause of it; that true gleet or latent gonorrhea was not infectious; and that latent gonorrhea was a myth anyway. Gonorrhea, he believed, was the cause of not more than a fourth of all inflammatory pelvic processes, puerperal sepsis being responsible for the other three-quarters. In 1887 Dr. Hewitt of London stated his impression that the tendency to pelvic cellulitis was greater in American than in English women, perhaps because of differences in their constitutions. Emmet thought that the difference in incidence arose from the fact that young women in America went into society earlier and had charge of themselves sooner. Pelvic inflammations, he pointed out, arise from exposure and imprudence in dress.

In 1892 Baldy restated his position, saying that he had no more doubt about the curability of gonorrhea than he had about the curability of scarlet fever. The previous year Noble had said that salpingitis was a very important cause of sterility and in 1892 he supported the position first taken by Noeggerath in 1873, as did several others who participated in the discussion, but many of the members still held to the old ideas. One did not accept the tendency of gonorrhea to persist and another, like Baldy, did not think that cure was difficult. E. P. Davis stated that the higher in the social scale was the patient, the less was the likelihood of cure; Negroes tended to recover completely, he said, which suggests that his experience was more limited than the experience of those of us who are working today in the New Orleans Charity Hospital.

In 1893 Parvin put the matter on a really lofty plane. In a welter of poetry, Latin quotations and other purple patches, he pointed out that gynecologists and other physicians have a social and moral responsibility to protect women as well as to cure them. If the double standard were abolished, he said, and if the women required the man "to come to her in holy marriage, in the glory of his unfallen manhood, as he requires her to come to him in the beauty of spotless maidenhood," then all the consequences of gonorrheal infection would cease and "a reign of social purity" would prevail.

In 1895 Van de Warker returned to the medical attack. It was a real advance, he said, to attribute so many things to periadnexal or adnexal suppuration, but it had so worked out that "to one who used facts as a mental searchlight after truth it was but the exchange of one form of despotism for another, more arrogant and aggressive than the first." He described "the pelvic, tubal or ovarian extirpator, intolerant of the very term cellular inflammation; the salpingotomist, who saw nothing but peritoneal and tubal disease, and who was just as much an obstacle to advancement as the theorist he displaced." His final respects were paid to the "hysterectomist," who was replacing the "salpingotomist," and who, when the removal of the adnexa did not cure the patient, blamed and extirpated the uterus, "the most inoffensive organ in the female pelvis." Over all the confusion the calm voice of J. Whitridge Williams was again heard, again pointing out from his position at the autopsy table that while true pelvic cellulitis can exist, without involvement of the tubes and ovaries, most cases of pelvic inflammatory disease are of tubo-ovarian origin, a position, of course, which Dr. Miller always held and from which he never deviated.

CARCINOMA OF THE CERVIX

How to treat cancer of the cervix was discussed with the same vigor at the early meetings of the American Gynecological Society as the diseases already mentioned, and, for the most part, with an equally incorrect concept of the pathologic process. In the first years much of the discussion concerned the value of high amputation of the cervix, which had been originated by Osiander of Göttingen early in the nineteenth century. It carried a terrible mortality from hemorrhage and many of the remarks had to do with the boldness of concept, fearlessness and recklessness of the men who were practicing it or who were advocating other radical surgery for cancer. These exhibitions of "surgical temerity," said Jackson in 1883, should be stopped. Some of them, he went on, were little more than antemortem examinations, "whose chief usefulness consists in demonstrating how long the owners are able to survive the loss of certain bodily organs." He thought that a halt should be called to an operation which destroyed 70 per cent of lives within a few hours or days, which destroyed 50 to 75 per cent of the survivors within a few months and which destroyed the remainder as promptly as if no operation had been performed. If a female premium-payer in a life insurance company, said Jackson, should be found to have cancer of the uterus, she would not be advised "by the shrewd men who manage that sort of business to have the uterus excised." The majority of the members who spoke on the subject were in complete agreement with him.

Mundé, in 1884, thought that the condemnation of vaginal hysterectomy for carcinoma at the preceding meeting of the Society had been hasty, premature and not based on experience. When it was properly performed, he thought it had "a brilliant and permanent future." The arguments continued, and in 1889 we find Byrne "promoting the interests of humanity" by trying to check "the prevailing craze for pelvic evisceration," his idea being to substitute for it the method of galvanocauterization, which he had employed for the past twenty years. That he had few follow-ups he explained as due to the "nomadic character" of the population, which made it impossible to secure information except from "a well-organized body of professional detectives." Lack of time prevented a comparison of his cases with the "exploits of the hysterectomists." A. R. Jackson agreed with Byrne that total extirpation of the uterus "had been a ghastly failure and a stupendous breach of promise, not only worse than any other treatment but worse than no treatment at all."

Three years later Byrne, then president of the Society was back at the old argument. He implied that those who reported operations for cancer were suppressing their mortality. He explained reported good results by runs of luck. These surgeons persisted, he said, apparently entirely blind to his own similar persistence "in displaying an unworthy and unbecoming spirit of intolerance and a lofty contempt for their more conservative brethren." He held up to scorn a certain Dr. Cushing, who exhibited "one of the trophies of his skill," in reporting that he had snipped off a little growth the size of a filbert, found it malignant, and then removed the whole uterus, since he had publicly gone on record as advocating that procedure whenever he found cancer in the uterus. Byrne lacked words "sufficiently expressive of my horror at the advocacy of this truly shocking doctrine and my unqualified disapproval of the fruits of its pernicious teaching." Then he paid his respects to "the brilliant surgical engineer" who had originated the idea of removing a large part of the pelvic basin for carcinoma. He would go even further, he said: "The ureters, for example, might be inserted into the rectum, and thus compensate for the loss of a disabled bladder by furnishing a perpetual enema. This would thoroughly annihilate constipation, so often a sore trial to defecating humanity." Well, in the later years of his life Dr. Miller several times performed the very operation Byrne envisaged with so much scorn.

By the time Byrne had finished his strictures on those who advocated surgery for carcinoma of the cervix and uterus and had reported his own good results with galvanocautery, the meeting was so impressed that it resolved to depart from its hitherto strictly observed rule that papers read at the meeting should be published only in the Transactions and recommended the publication of this particular address in one of the medical journals. It also requested the president to describe his technic, which he obligingly did in a second paper published in the Transactions the same year.

Many a year was to pass before the treatment

of carcinoma of the cervix was in any way standardized. Dr. Miller lived through the years of the Clark-Wertheim operation and came to use radium almost exclusively for this condition. Now the pendulum is swinging back in the other direction. In a certain proportion of carefully selected cases I am again using the radical operation, against which, before it had really become radical, the first members of the American Gynecological Society inveighed so harshly.

It is impossible, however, to criticize these men when one remembers how limited was their horizon. It is evident from their remarks that the modern concept of histology had not yet come into existence. On the other hand, some of them had very proper ideas. Byrne, in 1877, quoted Montgomery's objection to high amputation of the cervix for carcinoma, namely, that there was no way "of accurately determining whether the taint is really thus isolated or whether other parts are not already contaminated." It seems curious that twelve years later Cushing's removal of the whole uterus because he found a small malignant nodule should have been greeted with such indignation by this same observer. Mundé in 1884 said that the laity must be inculcated with a wholesome fear of vaginal discharges, not, he hastily added, that it was necessary that visits to the gynecologist should attain the frequency of shopping expeditions or the freedom from embarrassment of an afternoon social call or a coffee party. Early diagnosis would always be difficult, he said, but it did not follow that the establishment of the diagnosis meant that there was no hope for cure. He also pointed out that early diagnosis was possible by means of the microscope. In 1891 Janvrin said that the question of limitation of the disease to the cervix must be settled by biopsy and examination of the specimens secured by curettage, and he also insisted that statistics for vaginal hysterectomy be separated according to whether the uterus had been removed on benign or malignant indications. The following year Boldt discussed the responsibility of the family physician in getting the patient to the surgeon without delay and then promptly destroyed the effect of that wise remark by adding that there was no conceivable reason why partial operation in cancer should be associated with a higher recurrence of the disease than its complete removal. Naturally, until that concept was altered, carcinoma of the cervix remained for all practical purposes an incurable disease.

ECTOPIC PREGNANCY

In the first years of the American Gynecological Society there were many ardent advocates of the management of ectopic pregnancy by electricity. In 1886 Reamy said that while this method had had to fight its way through "obstinate skepticism," and still had not received the general and intelligent trial it deserved in gynecologic conditions, at last its general use in ectopic pregnancy was becoming established. Engelmann, although he was in agreement with the speaker's ideas, warned that when it was used, the consent of the patient must be obtained, since "a feeling of holy dread of this mysterious agent pervades the public mind." I might pause to say that this feeling was very well justified since electricity was advocated for neoplasms of all kinds, pelvic inflammatory disease, uterine hyperplasia, stenosis of the uterine canal, chronic ovarian inflammations, engorgement and pain, prolapse and other displacements, metrorrhagia, some forms of amenorrhea, hysteroneurosis, chorea and other nervous disturbances of puberty and the menopause, some urinary difficulties and a number of obstetric complaints and complications.

To return to ectopic pregnancy, it is interesting to find that while the campaign for a more general use of electricity was being waged, there were also advocates of immediate operation. White and Thomas both spoke in favor of operation in 1879, and Janvrin underwent his conversion in 1886. In that year he reported the case of a patient with ectopic pregnancy whose original symptoms were attributed to nervous shock but whose true condition was diagnosed on the second examination, in the course of which rupture of the tube occurred. She was treated with morphine and brandy and was given three electric treatments (by an expert who had treated twelve other patients) but she nonetheless died of hemorrhage. Two years later, therefore, the former exponent of electrical treatment is found advocating laparotomy in ectopic pregnancy as soon as the diagnosis is made, even if the only diagnostic criteria are bleeding, the presence of a mass, and sensitiveness on pelvic examination. The diagnosis, Janvrin said, could be made as early as

the fifth or sixth week, and operation before rupture should be the method of procedure. In the course of the discussion W. A. Johnstone said that it must never be forgotten that an ectopic pregnancy is likely to rupture, that delay in diagnosis and treatment goes a long way to invite disaster, and that even if the child dies and a lithopedion forms, the patient is carrying around a dynamite cartridge.

Unfortunately, this sound advice was not generally followed. Hanks, in the 1888 meeting, said he had nothing against the laparotomists, "who have their privileges," but the general practitioner should be prepared to use electricity in ectopic pregnancy pending their arrival, especially as there was never any subsequent trouble when it was used early. It must be granted that Lusk had some logic on his side when he commented, in 1893, on thirteen successful operations performed in the second half of pregnancy, all with living children. "The fortunate results," he said coldly, "in some cases belong to the domain of miracle, and do not invite imitation." The lesson of ectopic pregnancy has been pretty well learned since these discussions went on, but there are still some deaths in this condition which can be attributed only to failure to comprehend it.

DISPLACEMENTS OF THE UTERUS

Over the years in which Dr. Miller practiced gynecology, displacements of the uterus became less and less important and operations for them more and more infrequent. He was, himself, extremely conservative and selected his cases very carefully. His favorite procedure when the operation was done only for the displacement was the Alexander operation, by which the round ligaments are shortened through small incisions in the inguinal canal. If the abdomen was already open, he preferred the Simpson method. I might add that the occasional displacement operation which I perform today is always done with the abdomen open for the simple reason that in the sixteen years which have elapsed since Dr. Miller died, advances in surgical technic and surgical adjuvants have made intraperitoneal operations far safer than they were even in 1936.

Uterine displacements were treated in no such cavalier manner in the first years of the American Gynecological Society. Almost from the beginning they occupied the attention of the members. Medical measures in addition to the pessary included, said Jarman in 1895, curettage for endometritis; massage, which was supposed to stretch the contracted ligaments; electricity, as I have already mentioned; regulation of the bowels and the internal use of red iodide of mercury, though the speaker confessed frankly that he had no idea why that particular agent should be beneficial, a comment that might equally well be made of many of the measures employed for other conditions now as well as then. Pelvogenital massage, said Mundé in the same year, was reported to give highly satisfactory results, but the method was not popular in America, "which on reflection and considering the highly sensitive character of the majority of our ladies, does not seem particularly surprising."

Pessaries were widely used. Gaillard Thomas said in 1888 that gynecologists were divided into two classes, those who knew how to use pessaries and those who didn't. He added that he himself always carried a pessary in his pocket, and reports of hundreds of pessary-treated patients were not at all unusual. The stem was also very popular. In 1888, in the discussion to which I have just referred, Van de Warker said that he had advised it ten years earlier and that nobody, including Thomas, agreed with him; now Thomas was also using it. However, if he had lost a patient treated in this manner in the earlier years, there would have been no gynecologic authority to save him from the charge of manslaughter. H. P. C. Wilson closed that particular discussion by remarking that any man who ostracized the stem had better stop practicing gynecology.

As to surgery, an occasional amputation of the cervix was performed for displacement, but the Alexander operation and ventrofixation were the most generally favored surgical methods. Of course, as Thomas pointed out in 1888, it was necessary, if surgical treatment was decided on, that the patient and her family be warned of the risk and that relatives be fully prepared for a fatal outcome, but his opinion may have been warped by his partiality for pessaries. His remarks might well have been taken at their face value, however, for the Alexander operation carried a mortality of 1 to 6 per cent, and A. P. Smith, in 1895, said that he had heard of a case in which the search for the ligaments lasted an hour and a half. In view of the complete physiologic unsoundness of ventrofixation it is difficult to realize that it was

the great Howard Kelly who described the operation in 1889. Cleveland, in 1895, preferred it to all other methods except for the disastrous consequences of a subsequent pregnancy, and A. P. Smith in the same year said that it had afforded him the greatest satisfaction of all the operations he had ever performed from the standpoint of effective results, small risk and ease of performance.

As time went on some members of the Society had begun to realize that an undue emphasis had been put upon displacements. Priestley said as much in 1888, and in 1895 although he still regarded them as important, Mundé said that they were nothing like as important as they had once been supposed to be. A number of the speakers at earlier meetings had said that the Alexander operation was based upon unsound principles and had a very limited field, and in 1895 Mundé said that ventrofixation was unphysiologic and that the risk it introduced was unjustified. Yet it was only two years earlier that Edebohls, in discussing operations for prolapse, had remarked that whenever the uterus was preserved, it should be *securely* ventrofixed; the italics in which securely was written are his and not mine. At any rate, by the time Dr. Miller began to practice gynecology, there was some realization that displacements did not contribute greatly to the ill health of women, and that realization steadily increased as the years passed.

OTHER PRACTICES

There are a great many other things in these Transactions which, if time permitted, I should like to tell you about. The women of those days, for instance, were of a different race and breed. There was one who seldom left her chamber, and another who found the sight of even the pictures of certain persons and objects distressing to her; it was her rather peculiar custom to wear loose clothing and often merely to wrap herself in a sheet. Then there was the widow lady of unblemished reputation who had a sloughing fibroid and another, clearly not in the same category, who, for reasons I need not elaborate, had been sent from the South to hide her shame. There was the patient whose constitution, always fragile and delicate, was not benefited by travel in Europe; on two occasions her husband, himself, aspirated her ovarian cyst. There was a lady of thirty years who had suffered more or less from her sixteenth year from a cold then taken. There was the patient with hystero-epilepsy, who had not had even a spoonful of water for ninety days. She had been nourished on four daily enemas of milk and whiskey or beef tea and whiskey, and it was astounding, said her physician, how well preserved she looked on this slim diet. And then there were the directions for simple and practical methods in dress reform proposed by Dickinson in 1893 for this race of women. You must see the illustrations of these garments to believe them. I will merely report his statement that the outfit was economical, saved wash bills, and could be bought ready-made. The skirt he proposed, he added, rendered the shape of the legs less conspicuous when the wearer was walking or in the wind and prevented their contour showing against the light.

I am sorry that I have not time to tell you about the 1895 contribution on foreign bodies left in the abdomen at operation. It was difficult, said the author, H. P. C. Wilson, to collect the cases, because naturally "every honorable gentleman is unwilling to speak of such an accident in the hands of a brother practitioner, when the latter has not published it himself." Lusk, also in 1895, was unable to understand the "peculiar notions" of a family physician who was unwilling to give opium for pain or an antipyretic for fever, for fear of masking the symptoms. "What that means," said Lusk flatly, "I do not know." Byrne in 1892 inveighed against "the reckless clinical study of statistics" to justify "extreme methods," which in his book meant hysterectomy. Wathen, when he was criticized for dismissing patients so soon after operation as sixteen or twenty days, said apologetically that he tried to keep them a minimum of three weeks, and really preferred four, though this was not always possible.

There was a rather general theory, held as late as 1891, that deaths after operation were more frequent among healthy, strong women than among "those who have endured much, have been long sufferers, their constitutions, perhaps, having become inured to suffering." There were endless discussions of when it was best to operate. It was generally agreed that surgery should not be undertaken for tumors until the patient suffered from pain or pressure, or the growth had become very large,

or her health was failing. Climatic influences were originally thought of great importance in the selection of the time for operation. It was not a member of the American Gynecological Society who would prefer to operate in March with a south wind rather than in June with an east wind, but it was a member, Battey, who "for obvious reasons" never operated on a Friday. He had enough responsibility, he said (as indeed he did; you will remember that it was he who first proposed the removal of normal ovaries), without taking on any extra load, and he wanted to give his professional brethren no hammers to beat his head with. Wilson, however, just because it was ostracized, preferred Friday to any other day; he had a good deal of contrariness in his disposition. Smith in 1893 suggested that the patient enter the hospital three days before operation. On each of these days he would have her soaked in a tub for twenty to thirty minutes and would use laundry soap on her.

Reeve in 1891 suggested the preoperative use of morphine and atropine (probably not for the patients who were given whiskey along with chloroform on the operating table) but Baldy could see no advantage to this method in the properly prepared patient, this being a patient who had had no food or fluid for a considerable time and whose bowels had been moved six to twelve times. Ford in 1895 would not wish urinary suppression after operation to be attributed to urinary disease. The emotional state before operation, he pointed out, results in flushing out the kidneys, so there is no necessity for free secretion afterward. One may speculate whether he would have dismissed lower nephron nephrosis or the hepatorenal syndrome quite as blithely. Hunter, in 1886, had a couple of sound remedies for patients who complained of pain after operation. Most of them, he thought, were neurotics and he advised them to take long walks (miles, in fact) and gave them asafetida to keep their minds occupied.

It was in 1885 that W. T. Howard, in his presidential address, expressed his opinion of microscopic diagnosis. It will often, he said, "elucidate and render positive a doubtful diagnosis when used in connection with the character of the fluid, the clinical history and physical examination of patients, yet in the hands of the average microscopist it is misleading and untrustworthy." Polk in 1889 felt that it was a mistake in operating for retroversions and retroflexions to encourage union by first intention; a little suppuration along the line of the ligament was never out of place. It was in 1895, in a discussion of catgut, that Polk also remarked, in reply to Mann's statement that catgut could scarcely have killed one of his (Polk's) patients, in view of the bacteriologic demonstration of the absence of germs, that that depended upon "whether you tie yourself absolutely to the theory that only germs can produce inflammation."

CONCLUSION

I hope that I have not given you an unfair picture of the meetings of the American Gynecological Society in its first years. I have not meant to do that. For one thing the meetings seem to have been conducted with a vigor and interest which many modern medical meetings lack, not, I am afraid, because we are more courteous than our forefathers but because we are more timorous. Then I must emphasize again that these were the years when the principles of modern gynecology were being forged, and that this Society perhaps did more than any other single organization to stabilize them. Dr. Miller became a member in 1916 and served as its president in 1929. I know that he cherished the membership and regarded the associations as among the most fruitful of his medical life.

There were many wise things said at those early meetings, even with the limitations of the knowledge of those days. Some of them I have already called to your attention. There were contributions made which are still of value: Kelly's paper, for instance, in 1888, on palpation of the ureters in the female, and Williams' comprehensive discussion of tuberculosis of the female generative organs in 1892, still in large part sound because in large part it was based on his own studies in the laboratory and at the autopsy table.

I might well close this presentation with two remarks, one made in 1890 and the other in 1887. Said G. C. Bantock of London, a guest of the Society at the 1890 meeting, in a discussion of the causes of death in gynecology: "When I lose a case, I can always account for the result by one of three things, viz., something that I have done, something that I have omitted to do, or something it was impossible

to do." Provided that one does not unduly extend the last of these reasons, those of us who are practicing gynecologic surgery now, and those of you who may practise it in the future, might profitably be guided by that wise and down-to-earth remark when we are confronted with our own failures. The other remark to which I have reference was made by Skene in his presidential address in 1887. "The busy operator," he said, "may, while he pauses to wipe the perspiration from his own forehead, look back and join in the effort to solve the problem of the real and apparent value of all his doings." That is still an extremely good idea.

BENIGN esophageal tumors are rare; often they are extramucosal and can be enucleated without entering into the food gullet. In other instances esophageal resection with end-to-end anastomosis becomes necessary. Leiomyomas, neurofibromas, fibromas and intramural cysts arising from bronchial or esophageal cell rests comprise the majority of these growths and, characteristically, only the bronchogenic cysts contain cartilage. Dysphagia, chest pains, cough and dyspnea are some of the common symptoms. Contrast x-ray examinations of the esophagus are of diagnostic importance. Esophagoscopy may be performed if indicated; but where the lumen is intact, it would be unwise to take a biopsy. (*Richard A. Leonardo, M.D.*)

Case Reports

GASTRIC GRANULOMA WITH EOSINOPHILIC INFILTRATION

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EOSINOPHILIC granuloma of the bone or soft tissues, although an uncommon lesion, is a well known clinical entity. Eosinophilic granuloma of the stomach, however, is a clinical rarity and we have been able to find only eight cases reported in the literature. We are presenting the ninth case of gastric granuloma with eosinophilic infiltration and a discussion of the pathologic characteristics.

CASE REPORT

A white male, aged fifty-eight, was first seen by one of us (L. A. B.) on April 12, 1947, complaining of epigastric distress, anorexia, nausea on eating, belching, weakness and fatigue. The patient had been under treatment for an ulcerous stomach for fifteen years with only moderate relief from the recurring epigastric distress. Symptoms had become worse in September, 1946, but he had been assured it was merely a nervous stomach and was treated with sedative mixtures without relief, the gaseous eructations becoming more constant. During this latter period the patient suffered a weight loss of 25 pounds which he believed was due to his diet. Past history disclosed a neisserian urethritis at twenty years of age, a right inguinal hernia since thirty-two years of age, and chronic bronchitis and mild hypertension for many years. He had lobar pneumonia in February, 1946, and excision of an infected birthmark of the back five months later. On examination the temperature was 98.0°F. (oral), pulse rate 60, respiratory rate 14 and the blood pressure 180 systolic and 90 diastolic. The positive findings elicited were occasional expiratory wheezes auscultable over the entire lung fields, a tender mass in the right upper quadrant of the abdomen and a right indirect inguinal hernia. Gastrointestinal x-rays revealed a stomach sthenic in position but hypotonic in tonus, with a large non-opaque fluid residue present. Peristalsis was irregularly present with frequently no waves noted. There was a gross deformity involving the antral end with a definite shoulder formation and involvement extending back from the pyloric valve for about 5 cm. This area was constricted and ragged in outline giving the appearance of a "napkin ring" annular neoplasm. There was a gross four-hour residue.

A gastric malignancy was suspected, surgery advised and the patient admitted to Monmouth Memorial Hospital, Long Branch, New Jersey, on May 5, 1947. Blood study revealed a hemoglobin of 11.5 gm. (75 per cent), 4,170,000 red blood cells and 8,650 white blood cells per cu. mm., with 59 per cent polymorphonuclear leukocytes, 39 per cent lymphocytes and 2 per cent eosinophils. Blood serologic tests for syphilis (Mazzini and Wassermann) were negative. The blood sugar was 82 mg. per cent and the urea nitrogen was 15.2 mg. per cent. A complete urinalysis was normal and gastric analysis showed a moderate hyperacidity.

The patient was given a transfusion and on May 8, 1947, an operation was performed under spinal anesthesia through a high right paramedian incision. An induration involving the entire circumference of the stomach was palpable in the distal, one-fourth extending to 1 cm. beyond the pylorus. Strong, deep peristaltic contractions were visable through this area down to the descending portion of the duodenum. The liver, gallbladder, pancreas, and gastrohepatic and gastrocolic lymph nodes were normal. The stomach was opened

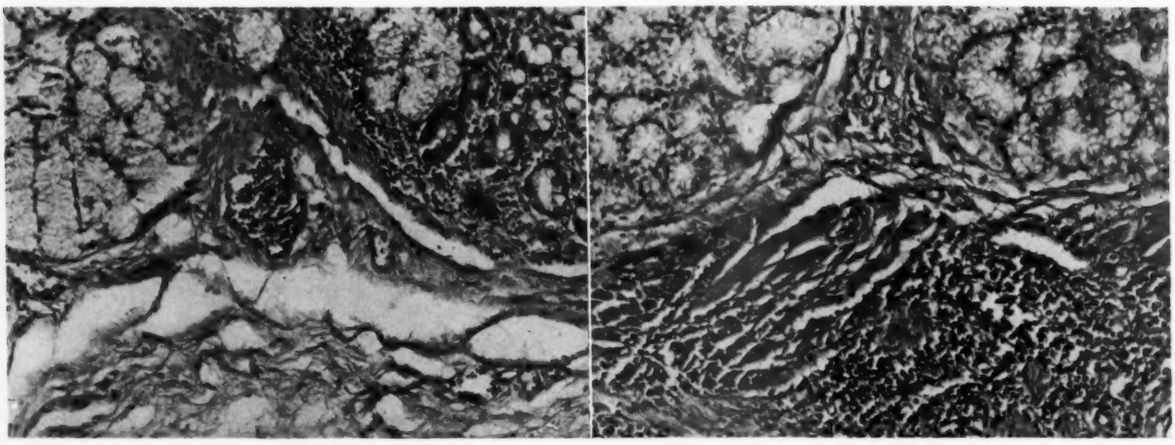

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FIG. 1. Photomicrograph of gastric mucosa and submucosa proximal to granuloma showing absence of eosinophilic infiltration. × 235.

FIG. 2. Photomicrograph showing comparable area in granulomatous region demonstrating eosinophilic infiltration limited to the submucosa. × 235.

anteriorly for further exploration and no intraluminal mass found, the pathologic disorder being confined to the wall of the stomach. The gastrotomy incision was closed and a Hofmeister-type subtotal gastric resection with an antecolic anastamosis performed, removing the distal two-thirds of the stomach. The abdominal wall was closed in layers with catgut sutures, no drains or retention sutures being used. Another transfusion was given during the operative procedure and a third during the immediate postoperative period.

Continuous gastric drainage (Wangensteen) was instituted for thirty-six hours and, in addition to the whole blood transfusions mentioned, the patient received glucose in distilled water and protein hydrolysate solutions intravenously, multiple vitamins parenterally and 50,000 units of penicillin every three hours intramuscularly. The temperature rose to 102°F. (rectal) on the first day and then fell to normal. A hacking cough developed on the first day but the patient was ambulatory forty-eight hours postoperatively. On the fourth day a wound dehiscence occurred and was resutured with through and through sutures of No. 6 braided silk, under spinal anesthesia. The fasc a and peritoneum of the central one-third of the wound were found to have separated for a distance of 3 cm.; loose catgut and blood clots were found lying free in this area. Dehiscence was believed to have resulted from a premature absorption of the catgut plus the troublesome cough. A chest x-ray the following day exposed a bilateral basal bronchopneumonia with a small amount of fluid in the left pleural space. It was believed that a process in the right base above the diaphragm might have represented an area of infarction. One week later a chest x-ray showed the processes to have cleared. A low grade fever of 100.4° to 101.0°F. (rectal) was present for four days following the resuturing procedure. The remainder of the patient's recovery was uneventful. He was discharged on May 22, 1947, fourteen days postoperatively, and the sutures removed on the eighteenth postoperative day.

The patient gained weight rapidly, developed an excellent appetite and stated he felt better than he had in thirty years. He has been followed closely for almost four years and has been completely free of gastrointestinal symptoms. It is interesting to note that blood counts done on the ninth postoperative day and two years following surgery revealed eosinophil counts of 7 and 10 per cent, respectively.

Gross examination of the resected specimen revealed fibromuscular hypertrophy of the distal gastric antrum and pylorus, 2 cm. in thickness, with a gelatinous appearance to the cut surface. The mucosal surface in general was smooth but there was evidence of submucosal petechiae in the pyloric region. Microscopic study disclosed extensive collagenous fibrosis with a marked diffuse infiltration of eosinophilic cells. (Figs. 1 to 4.) In some areas there were lymphocytic infiltrations.

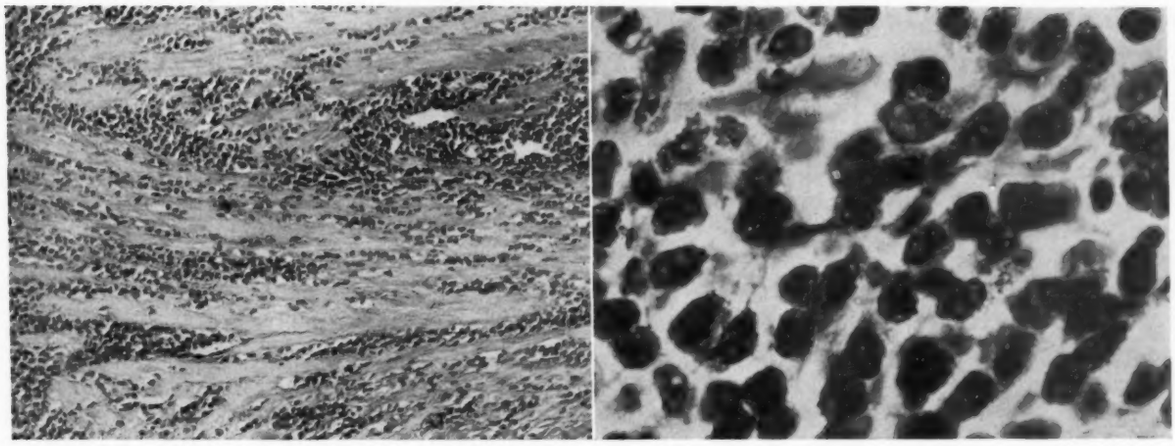

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FIG. 3. Photomicrograph of gastric granuloma showing the typical fibroblastic collagenous tissue with evenly distributed eosinophilic leukocytes and groups of lymphocytes infiltrating the submucosa. × 235.

FIG. 4. High power view of infiltrating cells demonstrating the marked preponderance of eosinophilic leukocytes. × 2200.

The mucosa showed some chronic inflammatory reaction with lymphocytic infiltration but there did not appear to be any invasion of the basement membrane. No malignant cells were seen.

COMMENT

The first report of an eosinophilic granuloma of the stomach was in an article by Kaijser[1] dealing with surgical gastrointestinal allergies. Published in 1937, this article discussed one gastric and two intestinal cases, the gastric case being resected and studied microscopically. An allergy to onion was considered the etiologic factor and a 26 per cent eosinophilic count was found in the blood count nine days postoperatively. The microscopic section was similar to that to be described.

A great deal of the present concept of this rare gastric lesion has been proposed by Vanek[2] who reported six cases in 1949. He described the gross and miscroscopic appearances in the six resected cases collected at the Charles University Medical School, Prague, Czechoslovakia, and found that they had the same features in common. The tumorous tissue was situated mainly in the submucosa, forcing the mucosa upward. The microscopic picture was one of fibroblastic collagenous tissue with evenly distributed eosinophilic leukocytes and groups of lymphocytes infiltrating the submucosa. Vanek stressed the difference from the microscopic appearance of the eosinophilic granuloma found in bones and soft tissues, consisting of basic cells of histiocytes or reticulum cells with the eosinophilic leukocytes densely accumulated in some areas and lacking in others. Because of the difference in pathology as well as localization he termed the gastric lesion "gastric submucosal granuloma with eosinophilic infiltration." Unlike Kaijser he could not find an allergic etiologic factor in these cases nor did the eosinophil count exceed the normal limit in the blood counts.

Polayes and Krieger[3] in 1950 reporting the first case of eosinophilic granuloma of the jejunum mentioned a personal communication from Stout in which he spoke of seven gastric cases he had seen; six cases were those collected by Vanek and the seventh case was picked up by chance in a stomach removed for ulcer.

Our case paralleled Vanek's cases in close detail. No allergic etiology was found nor could we classify this granuloma as one of the more common types listed by Banks[4] in Bockus' "Gastro-Enterology." The history and clinical picture were suggestive of gastric malignancy. The operative findings and procedure employed (subtotal gastric resection) were similar. The gross and microscopic findings and normal preoperative eosinophil count were the same.

SUMMARY

1. A case of gastric submucosal granuloma with eosinophilic infiltration is reported as the

ninth case in the literature. It is characterized by a history, clinical findings and a gross lesion suggestive of a gastric malignancy. The microscopic appearance is that of submucosal fibroblastic collagenous tissue with an evenly distributed infiltration of eosinophilic leukocytes and collections of lymphocytes.

2. Although an allergic reaction is suspected, the etiologic nature of the lesion is undetermined.

3. This lesion does not appear to be related to the eosinophilic granuloma of bone or soft tissues either locally or microscopically.

4. We believe this lesion is more common than reported to be and that by calling attention to it we may stimulate a search for the causative agent and a method of diagnosis in future cases reported.

Acknowledgment: We wish to acknowledge the excellent photomicrography of Mr. Leo Goodman, Mallory Institute of Pathology, Boston City Hospital, Boston, Mass., who produced our illustrations.

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TOTAL GASTRECTOMY FOR CHRONIC DIFFUSE GASTRITIS SIMULATING CARCINOMA*

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THE common causes of gastric obstruction are gastric ulcer, malignant lesions of the stomach and duodenal ulcer. Bockus[1] stated that severe gastritis which causes symptoms in the absence of duodenal ulcer is rare.

Chronic gastritis requiring subtotal gastrectomy has been reported by Freedman and co-workers,[2] Harris,[3] Pollard and Cooper,[4] and Norgore and Shuler.[5] In these cases the gastritis was so marked that even at operation carcinoma was the most probable diagnosis; four-fifths of the stomach was resected with excellent results. MacKenzie, Macloed and Bouchard,[6] and Judd and Moe[7] reported cases in which pyloroplasty was required.

This case is reported in order to call attention to a rare type of gastritis, namely, chronic diffuse gastritis requiring total gastrectomy. Foot[8] stated that "in twelve years experience with surgical material in a large hospital only one such example has come to light." This has been the first case seen at this hospital in over twenty years.

CASE REPORT

A colored male, aged forty-seven years, was first seen at Mercy Hospital on May 29, 1950. His health had been good until ten months before admission when he had noted the onset of epigastric discomfort with belching and occasional nausea. These symptoms had become progressively troublesome and he began to have constant vomiting. The family history was non-contributory.

One day before admission the patient began to vomit bright red blood and finally on the day of admission he had a massive gastric hemorrhage. During this epidode of illness he had lost 45 pounds.

Physical examination revealed an emaciated, malnourished colored male, 74 inches (169 cm.) in height and weighing 76 pounds (34.5 kg.). Blood pressure was 100 mm. of mercury systolic and 55 diastolic, pulse 92 beats per minute and temperature 98.2°F. Palpation of the abdomen revealed mild epigastric tenderness. There were no other noteworthy findings.

FIG. 1. Chronic gastritis simulating linitis plastica; note the involvement of the entire gastric wall.

The results of laboratory studies included urinalysis, blood studies, flocculation tests for syphilis and liver function tests which were all interpreted as negative. Roentgenologic examination of the chest and abdomen gave negative results. Roentgenologic examination of the stomach and small bowel was attempted with failure because the patient was unable to swallow barium.

On June 2, 1950, the patient was given 2,000 cc. of whole blood and a laparotomy was performed. At this time it was noted that the stomach was inflexible and leathery; a diagnosis of linitis plastica was made. Due to the patient's poor condition a jejunostomy was performed.

Following this operation the patient was placed on jejunostomy feedings. He was

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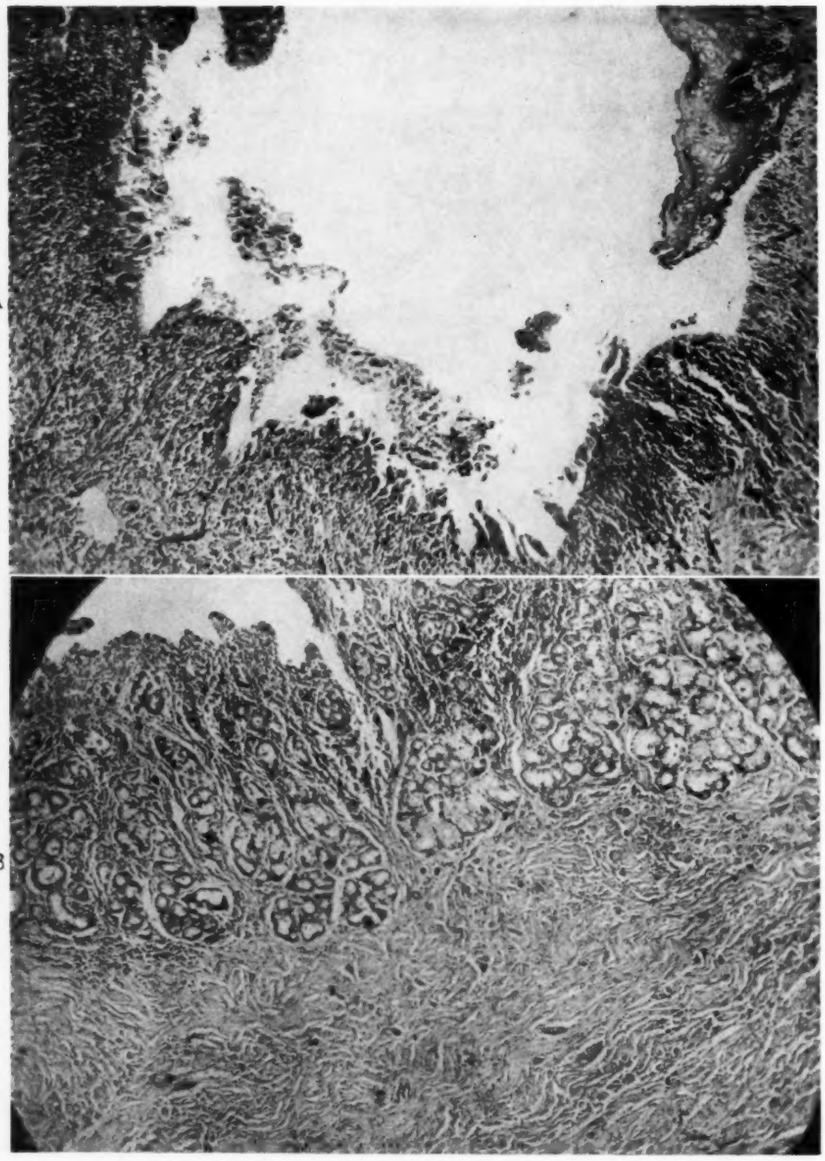

FIG. 2. Microscopic appearance. A, junction of esophagus and stomach; B, stomach showing marked fibrosis of the muscle wall devoid of cancerous cells.

closely followed up by blood studies and urinalysis. His weight rose from 76 pounds to 107 pounds in three months time.

A second operation was performed on the one hundred forty-fifth hospital day and a biopsy was made for frozen section which was negative for carcinoma. It was believed that due to the diffuse involvement of the stomach linitis plastica was still the most probable diagnosis. A total gastrectomy was performed.

The pathologist noted, before the specimen was opened, that the stomach was leathery but somewhat more flexible than that seen in linitis plastica. The lumen from the pylorus to the distal third of the stomach would scarcely admit the tip of a lead pencil. After the stomach was opened it was noted that the entire wall of the stomach was involved (Fig. 1) and it was difficult to make a final diagnosis. Careful microscopic examination failed to show carcinomatous cells but showed chronic inflammatory cells. (Fig. 2.) The final pathologic diagnosis was chronic diffuse gastritis.

The patient's convalescence was uneventful. He was able to eat liberally and was dismissed from the hospital enjoying better health.

COMMENT

This case is valuable in pointing out a possibility which may well be kept in mind when gastric obstruction is encountered. There is some question as to whether chronic diffuse gastritis (formerly known as linitis plastica) can exist independently of the presence of diffuse scirrhous carcinoma that now goes under that name. A diffuse infiltrative chronic inflammation may occur and be an independent condition unconnected with carcinoma. The picture is essentially the same except that the inflammatory infiltrate most totally lack neoplastic cells. Textbooks are always guarded that there can exist a non-cancerous form of linitis plastica and suspicion arises that many of these cases have been overlooked.

CONCLUSIONS

1. A case is reported in which total gastrectomy was necessary to alleviate obstruction due to chronic diffuse gastritis.

2. Chronic diffuse gastritis is rare and simulates linitis plastica in all respects except for absence of neoplastic cells.

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TREATMENT OF ACUTE POSTOPERATIVE PSEUDOMEMBRANOUS ENTEROCOLITIS

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BECAUSE few have survived the dreaded complication of acute pseudomembranous enterocolitis it is indeed fortunate that its incidence following surgical treatment is minimal. Contrarily, by limiting experience, uncommonness has undoubtedly accounted to a large degree for the extremely high mortality rate.

Pseudomembranous enterocolitis has been the subject of several studies but the basic etiologic and pathogenetic factors remain unknown and definitive treatment has been on an empirical basis. Heartened by two survivals, Dixon and Weismann in 1948 reviewed and presented the findings in twenty-three cases encountered at the Mayo Clinic following intestinal operations during a period of seven and a half years. Although they were unable to establish a cause, their clinicopathologic observations led them to believe that the prime cause of death in pseudomembranous enterocolitis was the marked circulatory collapse. Since both survivals received vigorous antishock therapy, these authors were of the opinion that, provided shock was combated promptly and heroically, this form of enteritis need not always have a fatal outcome. The conditions which they believed must be fulfilled for therapy to be successful are (1) cognizance of pseudomembranous enterocolitis as a possible postoperative complication, (2) prompt recognition of suggestive symptoms and (3) aggressive and immediate replacement of fluids with blood or blood substitutes while attempting to make a tentative or working diagnosis.

Because the diagnosis was of necessity presumptive in the two cases in which recovery occurred, the rationale of treatment advanced by Dixon and Weismann was hypothetic. Recently a case was encountered on the service of one of us (Dixon) in which an opportunity presented itself to test this treatment. The case is doubly interesting and constructive because, shortly after the patient had recovered from presumed acute pseudomembranous enterocolitis, death occurred from another cause and, at necropsy, lesions compatible with pseudomembranous enterocolitis were also found in the colon.

CASE REPORT

A seventy-six year old multiparous widow was admitted to the clinic November 2, 1949, with the chief complaint of passing three or four partially formed stools daily during the previous two to three months. The stools contained much mucus but no blood. About the same time a non-radiating, dull, aching sensation, which seemed to originate in the left lower quadrant, appeared. On admission her general condition was satisfactory although a loss of 10 pounds had been sustained despite a good appetite.

Physical examination revealed an obese, stocky, white woman, weighing 190 pounds, who presented no significant physical findings. A partially obstructing, slightly fixed, annular lesion was visualized 20 cm. from the dentate margin on proctoscopic examination. Biopsy disclosed an adenocarcinoma.

Roentgenographic examination of the colon was not attempted in view of the partial obstruction. With the exception of an elevated sedimentation rate of 32 mm. in one hour (Westergren method), the results of pertinent laboratory studies were within normal limits.

Following routine preparation of the colon with sulfasuxidine (succinylsulfathiazole), a non-palliative, open type, low anterior resection, with end-to-end anastomosis, was executed November 14, 1949, for a large grade 2 adenocarcinoma of the rectosigmoid (type B, Dukes) and a proximal loop type transverse colonic stoma was established. Before closure of the wound 2.5 gm. each of sulfathiazole and sulfanilamide and 5,000 units of penicillin were placed in the abdomen.

Postoperative response was satisfactory and uneventful for two days. Duracillin at a rate of 1 cc. (300,000 units per cc.) a day and dihydrostreptomycin at a rate of 0.5 gm. four times a day were started by intramuscular injection the day of operation. The colonic stoma was opened with the cautery early on the morning after operation. The following day flatus was expelled through the stoma, oral administration of clear liquids was begun and these were well tolerated. Later in the day ambulation was instituted.

On the morning of the third day after operation, excessive, watery movements from the colonic stoma began and by midnight the patient had had eight such movements. At noon the temperature was 102.5°F., the pulse rate 130 and the respirations 30 per minute. Because of the pronounced loss of fluid, 1,000 cc. of 5 per cent solution of glucose was started intravenously, later in the afternoon, in addition to 1,000 cc. of 5 per cent solution of glucose alone and 1,000 cc. of 5 per cent solution of glucose in isotonic saline which had already been taken orally. Paregoric, as well as aspirin, was prescribed to slow movements at the colonic stoma but only partial success was obtained. In the evening (8 P.M.) the temperature was 101°F., the pulse rate 110 and respirations 30. There were occasional cardiac extrasystoles, the lungs were clear and the abdomen was soft although slightly tender. A portable roentgenogram of the chest revealed only minimal linear atelectasis in the right midlung field. However, in view of the marked dyspnea and advanced age, the patient was placed in an oxygen tent. For the twenty-four-hour period ending at midnight of the third day the urinary output was 1,050 cc. During this day a minimal residue diet had been instituted and during the morning a routine determination of the hemoglobin concentration in the blood was reported as being 79 per cent.

At 3 A.M. on the fourth day after operation the patient went into profound shock following the passage of several profuse watery movements from the colonic stoma. The blood pressure immediately dropped to 80 mm. of mercury systolic and 0 diastolic and rapidly became unobtainable. The temperature was 105°F., the pulse rate 140 and the pulse thready, and decided hyperpnea was present. Since midnight only 20 cc. of urine had been passed. On insertion of a rectal tube in the colonic stoma over 1,500 cc. of watery excreta was expelled in a matter of five minutes. Apprehension was marked. It was thought that this probably represented an acute pseudomembranous enterocolitis and intravenous replacement therapy was instituted at once via three different portals using 18-gauge needles. Also 4 minims (0.25 cc.) of 1:1,000 solution of epinephrine was given subcutaneously. The response to the intravenously administered fluids was remarkable. Within a matter of minutes the patient received 500 cc. of whole blood, 1,000 cc. of 5 per cent solution of glucose in isotonic saline solution with 7½ gr. (0.5 gm.) of aminophylline added to stimulate renal function, and 380 cc. of dextran. This was followed with 1,000 cc. of 10 per cent solution of glucose with 30 cc. of adrenal cortical extract added. By 4:30 A.M. the profuse diarrhea had abated, 2,200 cc. of watery brown stool having been passed in the period of one and a half hours. The patient was excreting urine (200 cc. since 3 A.M.), the blood pressure was 110 systolic and 60 diastolic, and the pulse rate was 100. Five hundred milligrams of aureomycin was given orally and the dose was repeated every six hours for eight doses; the use of dihydrostreptomycin was discontinued.

At 7 A.M. a digitalis glucoside was given intravenously for probable auricular fibrillation. By 9:30 A.M. the blood pressure was being maintained and 800 cc. of urine had been passed since midnight. The pulse rate was 100 to 108 but frequent premature contractions were present. Another portable roentgenogram of the chest did not disclose anything of significance. There was no tenderness of the calves of the legs and Homan's sign was absent. Another dose of digitalis glucoside was given intravenously at 10 A.M. An emergency electrocardiogram confirmed the suspicion of auricular fibrillation. The rate was 135. At 2:30 P.M. the status was still improving. The blood pressure was staying well above 100 systolic.

Around 4 P.M. the digitalis preparation was again given intravenously because the pulse was more irregular and rapid. The blood pressure remained around 120 systolic. The urinary output for the twenty-four-hour period ending at midnight of the fourth day was 1,400 cc.

The following day the temperature and blood pressure were normal, the pulse rate was 90 and the rate of respiration 25. An oral intake of 1,500 cc. was supplemented with the intra-

venous administration of 1,000 cc. of 5 per cent solution of glucose containing added vitamins and 1,000 cc. of 10 per cent solution of glucose. The digitalis glucoside was prescribed daily for awhile in view of the fibrillation. The pertinent laboratory data obtained during the period from the third through the ninth days after operation are listed in Table 1. Water-chloride balance studies[4] were carried out on the fifth, sixth and seventh postoperative days but were discontinued after it was obvious that satisfactory balances were being maintained.

TABLE 1

LABORATORY DATA AFTER THE ONSET OF PSEUDOMEMBRANOUS ENTEROCOLITIS

Blood	Normal	Postoperative Day					
		Third (4 P.M.)	Fourth (10 A.M.)	Fifth (A.M.)	Sixth (A.M.)	Seventh (A.M.)	Eighth (A.M.)
Urea, mg./100 cc	10–40	30	38	..	28	....	..
Chlorides, mEq./L	.....	96	102.5	99	95	95	95
Carbon dioxide, mEq./L	25–29	19.6	20.9	25	32	32	30
Potassium, mEq./L	4–5	....	2.5	..	3.4	3.5	..
Cell volume percentage	40–48	....	32	35	41	45	45
Total proteins, gm./100 cc	6–8	....	.....	..	....	5.1	..

Leukocyte count on the fourth postoperative day: total 3,100 per cu. mm. of blood; lymphocytes 45 per cent; monocytes 8 per cent; neutrophils 47 per cent (filaments 1 per cent and non-filaments 46 per cent).

Urinary findings on the fifth and eighth postoperative days, respectively: specific gravity 1.015 and 1.017; reaction: acid, acid; albuminuria grade 2, grade 1; glycosuria grade 1, grade 1; erythruria grade 2, grade 3; pus cells none, occasional; and granular casts few, none.

While getting out of bed on the eighth postoperative day, the patient became dyspneic, cold and clammy, the pulse became weak, and she complained of retrosternal pressure. The attack subsided shortly.

The patient was recovering and beginning to ambulate again when death occurred suddenly on the evening of the tenth postoperative day. At 8 P.M., on getting back into bed after voiding, she became very apprehensive and dyspneic but shortly felt better. The pulse rate was 112 and blood pressure 100 systolic and 70 diastolic. At 11:20 P.M. the patient went into irreversible shock and the pulse became very rapid, thready and gradually imperceptible, the patient all the while complaining of pronounced dyspnea and retrosternal pressure. Despite all efforts at one's command death occurred within a few minutes.

The pertinent necropsy findings are as follows: Grossly, the esophagus, stomach and duodenum were not remarkable, but proximal to the site of colostomy were patches of granular hemorrhagic mucosa mingled with areas of white, smooth, thickened mucosa. This was believed to represent evidence of healing of a pseudomembranous ulcerative colitis. Microscopically, in the colon distal to the site of the colostomy was some superficial denudation of the epithelium. The number of round cells and eosinophils in the lamina propria was increased. There were areas of fat necrosis in the pericolic adipose tissue. In the ileum there was focal denudation of the surface epithelium, and a few polymorphonuclear cells were present in the lamina propria. Some areas showed increased fibrous tissue in the submucosa. A few dilated glands with atypical epithelium were seen. No actual pseudomembrane was observed. There were similar changes in the ascending and transverse colon. The anatomic diagnosis was (1) bilateral fatal and recurrent pulmonary embolism, with residual thrombosis of the right internal and common iliac veins, and (2) healing pseudomembranous ileocolitis.

COMMENT

It is not often that acute pseudomembranous enterocolitis is suspected prior to necropsy because only about 30 per cent of

the cases are associated with a voluminous, sustained diarrhea. In the remainder there is an outpouring of fluid into the lumen of the bowel but diarrhea is absent and the clinical picture is one of profound, unexplained shock. Why the diarrhea ceased in the case reported herein we do not know. Furthermore, we possess no evidence to state dogmatically that the diarrhea will ultimately abate and the patient live in those cases in which fluid loss is replaced promptly and adequately. However, we feel justified in continuing to advocate the employment of an aggressive program of fluid and electrolyte replacement for that 30 per cent of the cases in which the presence of acute pseudomembranous enterocolitis may be suspected by the surgeon and for this reason have cited this case. It is our belief that in this manner life may be maintained long enough in a few cases for the body to mobilize whatever forces are necessary to overcome the excessive loss of fluid and electrolyte.

To date, a number of investigations have failed to find an explanation for acute pseudomembranous enterocolitis, although it is known that similar lesions are seen in a number of other conditions such as uremia, certain toxic infections and poisoning from arsenic and mercury. Bacteriologic examinations of the fecal discharges performed in a number of cases have not disclosed the usual agents which produce primary enteritis. It is also noteworthy that the disease does not seem to be related to the preoperative use of sulfonamides or antibiotics since the lesions were found at necropsy prior to the advent of sulfonamides and antibiotics. Our case adds little to the meager knowledge of the etiologic and pathologic aspects of this complication.

As in the previous cases reported from the clinic, shock appeared in this case *after* the onset of diarrhea. This is in contrast to the observations of Penner and Bernheim, who, because shock was present in their cases in the postoperative period prior to the onset of enterocolitis, expressed the belief that the major factors in the pathogenesis of the lesions were vasomotor disturbances incident to postoperative or traumatic circulatory deficiencies. In the case reported herein the laboratory and fluid balance data present only the usual changes one would expect in dealing with any diarrhea of similar proportion.

On the basis of present knowledge chemotherapy or the use of antibiotics is not mandatory in the management of pseudomembranous enteritis but would definitely be of value in controlling secondary infection. Treatment with aureomycin was instituted orally shortly after restoration of the circulatory status in the case just reported. In view of the work of Dearing and Heilman this would seem to be the agent of choice. In the presence of vomiting or gastric suction with an indwelling tube, the intramuscular use of penicillin and dihydrostreptomycin should be as satisfactory as the intravenous use of aureomycin especially since the survivals of Dixon and Weismann, occurring before the advent of aureomycin, received only these drugs.

SUMMARY AND CONCLUSIONS

Only those cases of acute postoperative pseudomembranous enterocolitis which present severe diarrhea followed with shock suggest to the attending physician that he is dealing with this complication. In such instances, it has been contended that if vigorous antishock measures are instituted promptly and fluid and electrolyte balance restored, some of these patients will survive. In the case just reported, which was encountered following an anterior resection of the colon, the presence of this form of enteritis was suspected and it was successfully treated according to these principles. A few days later the patient died of a massive pulmonary embolus, and at necropsy, healing lesions consistent with the diagnosis of pseudomembranous enterocolitis were also found in the colon. Thus this was a case of proved pseudomembranous enterocolitis treated successfully.

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PATENT URACHUS

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CONGENITAL anomalies about the umbilicus have interested physicians for many years. One of the more frequent of these is patent urachus.

Bartholomaeus Cabrolius is credited with reporting the first case of this anomaly in 1550. Dudgeon states that there were no further reports of this condition until the eighteenth century when four cases were reported. It was not until the nineteenth century that appreciable series of patients with this anomaly were collected. In 1916 Cullen tabulated sixty-two cases of patent urachus in his treatise on diseases of the umbilicus. In 15,000 admissions to the Brady Urological Institute only three were concerned with the urachus. Only three instances of this anomaly were recorded in 200,000 admissions to the Children's and Infant's Hospital of Boston, Massachusetts. Mahoney and Ennis report that persistent urachus was an incidental finding on six occasions in 3,446 autopsies performed from 1914 to 1935. In none of these was there an umbilicovesical fistula.

Herbst gave an excellent and complete review of the subject of patent urachus in 1937 and collected 154 instances reported in the literature until the time of writing his own paper. One case was added by him, bringing the total to 155 patients. A fairly complete review of the accessible literature since Herbst's paper reveals thirty-seven more instances of patent urachus. The authors and the number of cases presented by them are listed in Table 1. It would appear, therefore, that approximately 192 cases of patent urachus have been reported in the accessible surgical literature.

Much of the interest in this subject centers about the embryologic and anatomic factors concerned. There is still no complete agreement in the literature concerning these matters.

Cullen states that the urachus is formed by the intra-abdominal part of the allantois as it continues upward from the bladder to the umbilicus and then to the cord. The bladder, according to Cullen, develops from the lower part of the allantois. The urachus and allantois soon become solid but they frequently tend to develop spindle-like dilatations in them. Cullen believed that these dilatations account for the cysts often seen later in life and that the urachus occasionally remains patent. Numerous other authors have expressed similar opinions.

TABLE 1
REPORTED CASES FROM 1936 TO JULY, 1950

Author	No. of Cases
Vertan (1936)	2
Mahoney and Ennis (1936)	3
Rintelen (1937)	1
Eiras (1937)	1
Gros (1938)	1
Slavik (1940)	2
Dudgeon (1940)	5
Dreyfuss and Fliess (1941)	1
Mikhelson (1941)	2
Meyers (1942)	1
Powers (1942)	1
Nichols and Lowman (1944)	1
Atcheson (1944)	2
Trimingham and McDonald (1945)	6
Williams (1946)	1
McClelland and Davis (1947)	1
Boccazzi (1948)	1
Garvin (1948)	4
Cherry (1950)	1

Begg, however, believes that the urachus is merely the superior extremity of the bladder and owes nothing to the allantois. As the bladder descends, it drags the urachus with it as a fibrous cord. Begg believes, therefore, that only the pathologic or undescended urachus extends to the umbilicus. In 33.3 per cent of his specimens a connection between the bladder and urachus was found. He states that the urachus extends only 3 to 10 cm. above the bladder apex, in most cases 5 cm. Begg consequently distinguishes between vesico-umbilical and uracho-umbilical fistulas. He believes that acquired umbilical fistulas are not due to a patent or persisting urachus but develop as the result of urine extending upward through the tissues of the abdominal wall, anterior to the peritoneum with the formation of an acquired fistula.

In a more recent paper Hammond, Yglesias and Davis considered the problem with somewhat different views. Their paper included a

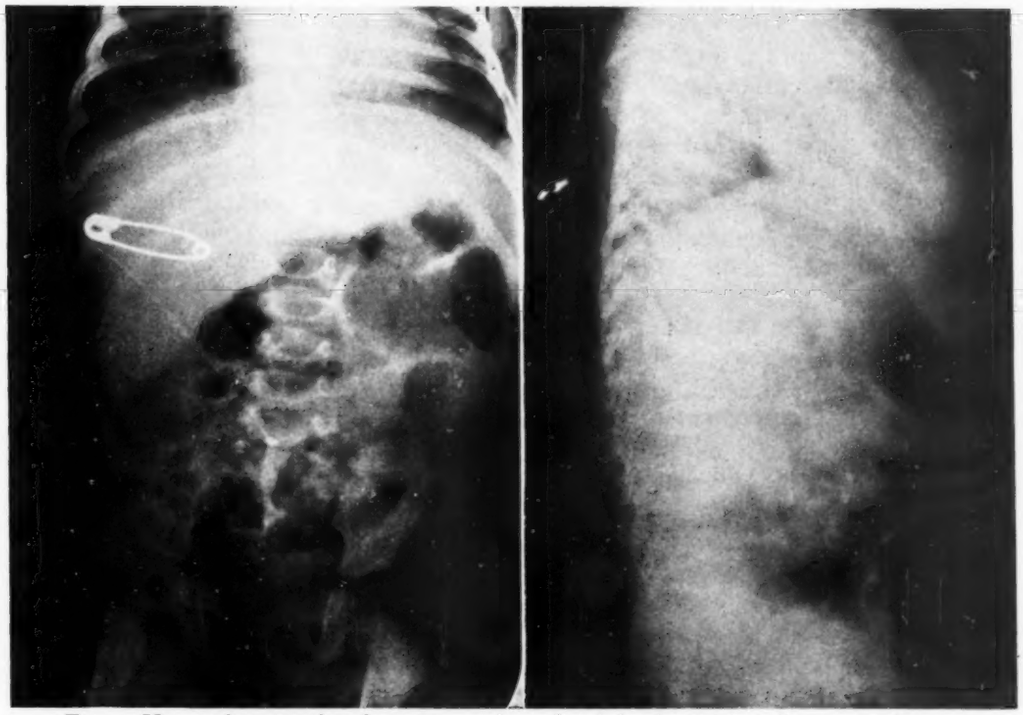

FIG. 1. X-ray photographs of patent urachus after injection with radiopaque substance.

study of thirty-five autopsy specimens from premature and term fetuses and one young child, and a careful examination of 100 adult cadavers. These authors found that the urachus could be traced as a definite tubular structure from the apex of the bladder to the umbilicus in all of the fetuses. In 25 per cent of the adult specimens the urachus was a grossly tubular structure, and in another 25 per cent it was a fibrous cord. In the remaining 50 per cent the upper half of the urachus was tubular and the remainder formed an atrophic cord. Gross continuity of the lumen from the bladder to the umbilicus could be demonstrated in only two specimens, a distinct contrast to the findings in the fetal specimens. These authors could not corroborate the theory of the descent of the bladder with the urachus forming a fibrous cord. It would appear, therefore, that the findings in any individual patient would depend greatly on developmental factors occurring as the individual grew from fetal to adult life. This would offer a much more plausible explanation of the varied embryologic and anatomic findings and the different opinions concerning them in the surgical literature.

The symptomatology, physical findings, diagnosis and treatment of this condition have been completely covered in many presentations on the subject. Diagnosis is seldom difficult and complete excision is the present accepted method of treatment.

The following case report is presented as an illustration of a successfully treated patent urachus in an infant:

CASE REPORT

M. V. W., a three month old female infant, was admitted to the pediatrics service of Misericordia Hospital, Philadelphia, on May 13, 1950. The child had had intermittent vomiting, moderate in frequency since birth and somewhat more marked the week before admission. The parents believed the child had had fever for two days prior to admission. There was nothing else of note in the present history and the child's past medical and family histories were negative.

Physical examination revealed a rectal temperature of 100°F. Examination was entirely normal except for the umbilicus which showed a fluctuant area covered with a thin, greenish skin. Shortly after admission to the hospital this area ruptured and thereafter drained small amounts of clear fluid through a tiny aperture in the lower part of the umbilicus. This fluid had an appearance much like urine. Urinalysis showed a trace of albumin and many white

blood cells. The hemoglobin was 9 gm., red blood cells 2,600,000 and white blood cells 25,000. Culture of the urine revealed Aerobacter aerogenes. X-ray of the chest was normal, as was flat x-ray plate of the abdomen. X-ray taken after injection of the opening in the umbilicus with diodrast was reported by the radiologist as showing "a somewhat tubular tract extending from the umbilicus downward and backward toward the upper margin of the bladder in the mid-sagittal plane. The appearances are characteristic of patent urachus which does not evidently communicate with the bladder." The diagnosis of patent urachus was agreed with by the attending pediatrician and the author as surgical consultant. The infant was given a blood transfusion and operated upon May 22, 1950. (Fig. 1.)

Exploration revealed a sinus tract extending from the tiny opening in the lower part of the umbilicus down to the bladder along the anterior surface of the peritoneum. The lumen was about 4 mm. in diameter and the lower end did not open into the bladder but extended to the bladder wall. The entire sinus was excised, necessitating removal of a small portion of the peritoneum with it as well as the overlying skin. The wound was closed in layers. The child made a completely uneventful recovery with primary wound healing and was discharged on the eighth postoperative day. Urinalysis became normal without further therapy and the blood count remained normal following the blood transfusion. The pathologist reported the specimen as being "a fistulous tract in which a bristle has been placed. A probe passes freely through the tract and the tract has a covering of skin. Sections at various levels of the tract show a lumen surrounded by marked numbers of chronic inflammatory cells and new capillaries. There is no remaining epithelium. Diagnosis: Consistent with patent urachus."

This child has grown normally, remained well and has had no further symptoms or signs referable to the umbilicus or urinary tract to the date of this report.

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OSTEOCHONDRITIS DISSECANS OF THE ELBOW

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Grand Rapids, Michigan

OSTEOCHONDRITIS dissecans, as defined by King and Richards,[1] is a noninfectious aseptic necrosis of a segment of subchondral bone of the long extremities resulting ultimately, although not invariably, in an osteocartilaginous sequestrum into the affected joint. In the knee joint it is not uncommon but its occurrence in the elbow is still regarded as somewhat of a rarity in this country. Also, when the condition does occur in the elbow, the lesion is practically always in the capitellum or head of the radius. In Roberts and Hughes'[2] series of thirty-eight cases (forty-four elbows) the lesion was demonstrated to be in the capitellum in forty elbows, in the head of the radius in two elbows and in both in two elbows. In King's[3] series the osteochondritic focus was found in the capitellum in all of his four elbow cases. Brickley and Grow,[4] Miller,[5] and Swenson[6] presented single cases, each of which involved the capitellum. Morton and Crysler[7] in 1945 and Ross[8] in 1947 suggested that the supratrochlear septum might be the site of a primary lesion although this has not been universally accepted.[2] A search of the available literature[1–20] fails to reveal any mention of the occurrence of the disease in the olecranon. Accordingly, the following is presented as a case of osteochondritis dissecans involving only the olecrannon.

CASE REPORT

R. W., a thirty-seven year old white man, was first seen on January 22, 1951, because of a painful left elbow. He gave a history of having injured the elbow in a fall as a boy but he had not sought medical attention. He occasionally had aches in the joint afterward but got along fairly well until approximately three or four months before, since which time he had had more soreness and stiffness in the elbow. Four days before he was seen he had sustained a slight injury to the elbow when he bumped it while at work. Soon after that the elbow "locked" at about a 160 degree angle and he was unable to flex or extend it. After working with it for a few minutes he was able to move it again; however, he could not completely straighten it and could flex it only slightly more than a right angle. The soreness also increased during the next few days.

On examination the elbow was not swollen and presented no abnormality on inspection. There was a marked decrease in the range of motion. The forearm could not be completely extended, stopping each time at about a 175 degree angle, and it could be flexed to only slightly more than a 90 degree angle. There was tenderness over the lateral aspect of the joint and over the head of the radius. There was no muscular atrophy of the arm or forearm.

Roentgenograms taken at Butterworth Hospital on January 22nd revealed a somewhat irregular contour of the articular margin of the ulna in the semilunar fossa and on the lateral aspect of the upper portion of the shaft. In the proximal end of the ulna, principally in the olecranon process, there was an area of rarefaction measuring about 3 cm. in size. Within the joint cavity were two loose bony shadows each measuring about 1.5 to 2.0 cm. in size. Stereograms showed that one of these lay anterior to the medial condyle of the humerus and the other, partly hidden by the overlying bones, lay distal to the lateral condyle and possibly adjacent to the posterior margin of the head of the radius. This latter loose body was in a position to cause locking of the joint. The capitellum and the head of the radius appeared normal. The impression was osteochondritis dissecans involving the olecranon. (Fig. 1.)

The patient was admitted to Butterworth Hospital on February 19th and operation was performed on February 20th. Through a posterolateral incision the joint capsule was exposed and opened in a longitudinal direction. A hemostat was inserted into the joint cavity and the two loose fragments were easily removed. They were not attached to the synovial membrane at any point. The first fragment was found just anterior to the medial condyle and the second was just above the head of the radius. The cavity in the olecranon was then explored and scraped with a curet. Many small

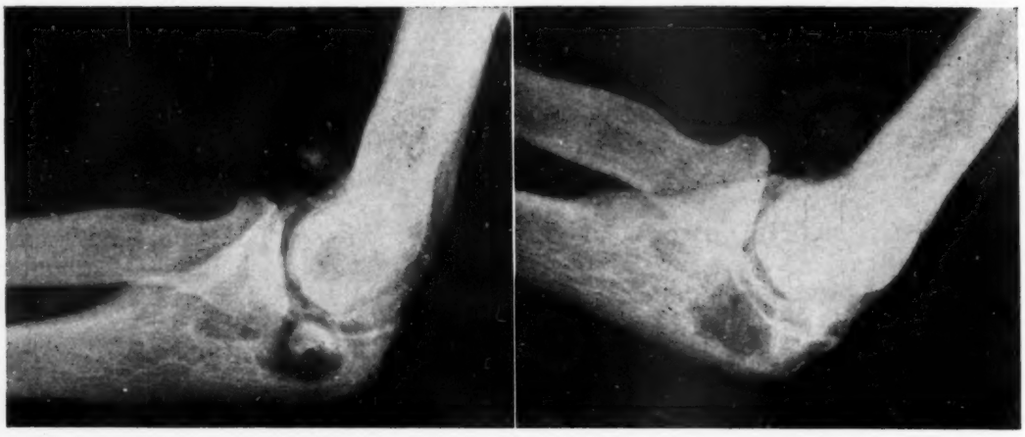

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FIG. 1. Lateral film of the left elbow showing the two loose bodies of bone in the joint cavity and the large rarefied area in the olecranon.

FIG. 2. Postoperative lateral film of the left elbow showing the defect in the olecranon and absence of the two loose bodies.

FIG. 3. The two large fragments removed from the joint cavity and some of the spongy bone removed from the defect in the olecranon by curettement.

fragments of spongy bone tissue were removed. The capsule, superficial fascia and skin were closed with interrupted No. 0000 silk sutures. A posterior plaster splint was applied with the arm in 90 degree flexion and the patient was returned to his room in good condition.

The postoperative course was uneventful. The splint was removed on the second postoperative day and active motion was started. At the time of the patient's discharge on the sixth postoperative day there was almost normal motion in the elbow. Two weeks postoperatively there was normal motion and no pain at all in the elbow. At the last examination five months postoperatively there was complete range of motion and no pain in the joint. A postoperative roentgenogram showed the residual defect in the olecranon and absence of the previously described loose bodies. (Fig. 2.)

The loose bodies removed from the joint measured approximately 1.5 and 2 cm. in diameter, respectively. (Fig. 3.) These were hard and had all the characteristics of bone.

COMMENT

It is believed that this case represents an osteochondritis dissecans arising in the olecranon. No similar case report has been found in the available literature.

Various theories as to the etiology have been advanced since Konig[9] in 1889 first applied the name to the disease. It was thought at that time that the loose bodies were dissected from the bone by a low grade inflammatory process. Since then the infectious theory has been pretty well discarded. Trauma has always been thought to play at least an important role. Phemister[10] in 1924 concluded that the process is the result of non-union following incomplete or subchondral fracture between cartilage and bone, or through bone, with subsequent severance of the cartilaginous bridge either by trauma or absorption. The etiology in this case was apparently an old injury, and the acute symptoms which caused the patient to seek medical attention (locking and increased pain) were brought on by another mild trauma.

SUMMARY

1. An unusual case of osteochondritis dissecans of the elbow is presented in which the

olecranon was the site of the pathology and the origin of the loose bodies.

2. A brief discussion of the etiology is presented.

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New Instruments

A NEW SURGICAL DISSECTING FORCEPS*

JOHN DEE FLETCHER, M.D.
Omaha, Nebraska

SURGEONS and anatomic dissectors find the process of obtaining a clean dissection field tedious and time-consuming. A new surgical dissecting thumb forceps has been devised to shorten this process by combining a cutting blade with the thumb forceps.

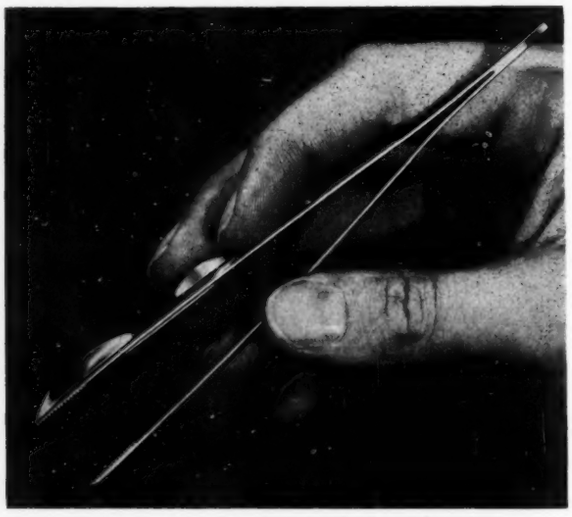

FIG. 1. The cutting blade attached to thumb forceps increases the usefulness of the instrument.

The surgical dissecting forceps consists of a thorn or hook-shaped cutting blade attached to the outer surface of one prong of a thumb forceps. (Fig. 1.) This blade is just proximal to the tip of the forceps. The blade is sharpened on its point and upper concave edge. The size, shape, angle and location of this blade may be varied to meet specific needs. A guard is provided to cover the blade when not in use. Light digital pressure releases the guard so that it may be moved readily from a guarded to an unguarded position or vice versa. (Fig. 2.) This may be done without changing the position of the forceps in the hand. The blade and guard have been designed so as not to interfere with the use of the instrument as a thumb forceps. The blade may be sharpened as necessary.

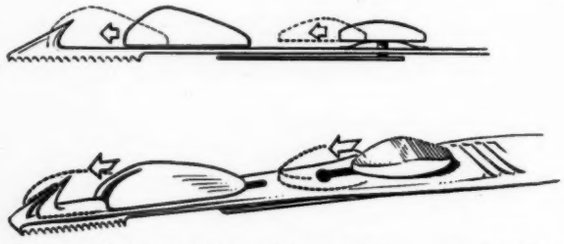

FIG. 2. The dotted lines indicate the movement of the guard from an unguarded to a guarded position.

Medical literature describes many different types of forceps. Pearlman and Leshin,[1] and Atkinson[2] designed instruments which utilize the principle of cutting edges on the tips of peritonsillar abscess scissors-forceps. The adding of a knife blade to thumb forceps provides the following advantages: (1) It aids in stripping and cleaning fascia from the larger vessels. (2) It is useful in separating muscle and fascial planes. (3) It decreases the handling of various instruments. (4) It may be used to cut small vessels or nerves.

It is believed that this instrument offers a means of conserving time both for surgeons and anatomic dissectors.

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A NEW OPERATING TABLE SCREEN*

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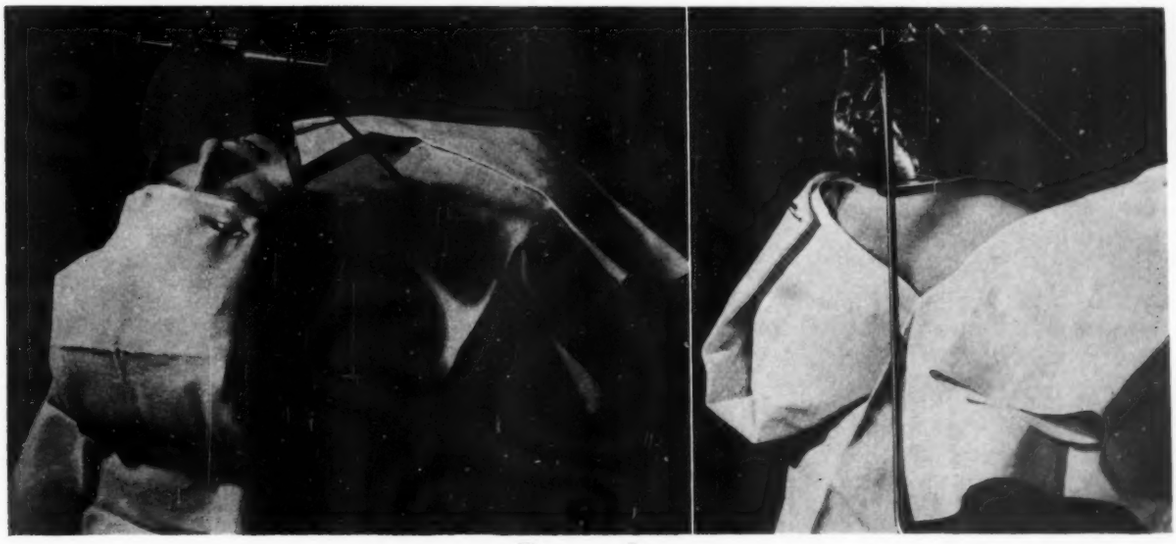
Madison, Wisconsin

"TRADITION is the enemy of progress" is an old saying that may not infrequently be applied to surgical traditions and more especially to the operating room. Since the early days of the operating table surgeons have been cramped for space when performing surgical procedures upon the neck, particularly upon the thyroid gland. Not only has the traditional screen been a factor in reducing the easy approach to the operative field, but also the draping sheets have all but smothered the patient undergoing surgery in a warm operating room. This has been especially true when cervical nerve block or local infiltration anesthesia has been used.

After two years of experimenting and trial on several hundred surgical procedures a new type of "windshield" screen has been perfected which embodies many desirable features.† (Figs. 1 and 2.)

† Through the cooperation of the Ohio Chemical & Surgical Equipment Co., Madison, Wis.



FIGS. 1 and 2.

The surgeon's operating field is not cramped and the operating team is given far more space to work. The patient is no longer smothered and kept uncomfortably warm but has plenty of fresh air and comfort.

The screen is entirely sterilized; thus no drapes or coverings are required. It affords complete protection for the operative field, and no instance of infection from the use of this screen has resulted. The horizontal bar has been extended at either end to permit holding skin retractors when not in use by the assistant. The screen has been made adaptable to fit the standard type surgical table. It may be used for other types of surgical procedures and is particularly desirable when spinal anesthesia is used.

The simplicity of construction and handling makes the screen a desirable addition to the equipment of the operating table from the standpoint of the anesthetist and the nursing staff.

* From the Jackson Clinic, Madison, Wis.

A NEW COLOSTOMY PROTECTOR

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Ithaca, New York

IDEALLY, a patient with a colostomy should train himself to have a normal bowel movement once in twenty-four or forty-eight hours either with or without the aid of an enema. With care and persistence most patients are able to accomplish this. Having done so they can lead a fairly normal existence and can protect the colostomy by a simple elastic belt and soft pad of gauze or cotton. Nevertheless the patients are still bothered by the involuntary escape of gas and are worried lest a sudden unexpected bowel movement cause them real embarrassment while travelling or attending business or social functions. All sorts of devices for the protection of patients from these situations have been devised, but apparently none of them are satisfactory to those individuals who are so unfortunate as to have a permanent colostomy. No further proof of this is needed than the continued development of new devices by those individuals who have a colostomy. Almost every colostomy owner becomes an inventor. So many devices have been invented and described that we have decided to describe a new one only because it solves the problems which confront a colostomy patient more simply and effectively than any other device we have seen.

The patient who designed this device is an industrial engineer whose occupation required him to do considerable travelling especially in airplanes. He was by temperament quite nervous, and in spite of the fact that by means of irrigations he was able to have a normal evacuation only once in two days, he was always afraid that he might have an involuntary bowel movement while in a conference or on an airplane. He was also upset because from time to time he involuntarily passed foul gases, and this caused him a great deal of embarrassment. In addition he noted that the soft pad which he wore over his colostomy caused sufficient irritation of the exposed bowel to produce a constant discharge of mucus. This mucus moistened the pad and the moisture irritated and excoriated the skin about the colostomy. In order to overcome these problems he devised what he called the deodorizing colostomy protector. This device can be comfortably worn without attracting attention. It is light, durable, easily cleaned and does not absorb odors. It permits the escape of gas but not of odors and, what is most important, it protects the patient against the hazard of an occasional involuntary escape of liquid material. The patient who wears it, however, must employ irrigation or other methods of controlled evacuation. It is not designed for those who have an uncontrolled colostomy. It is so light and so well designed that the wearer can engage in all sorts of ordinary activities which require bending and turning without discomfort or fear of dislodging the protector.

Briefly, the protector consists of a light weight plastic chamber which covers the colostomy and is held snugly against the skin by means of an adjustable nylon elastic belt. The edges of the chamber meet the skin in such a way as to provide a non-irritating watertight seal. In the center of the top of the chamber is a perforated removable cap screwed onto the rim of an opening into which is placed the small cartridge containing a deodorizing filter. These filters allow the passage of gas but not of odors or liquids. Each filter is sufficient for a full day unless it gets wet. They are cheap and are supplied in air-tight containers which must be kept tightly closed lest the filters absorb odors from the air and become useless. A small perforated plastic disc is supplied which can be used in place of the filter if none are on hand. This is used to hold a small piece of gauze or cotton in place of the filter. The entire protector weighs less than 2 ounces and it can easily be cleansed with soap and water under an ordinary faucet. (Fig. 1.) Since it is made of impervious transparent plastic, it does not absorb odors as does rubber or other soft material and it permits the wearer to observe the conditions inside the protector without removing it. With proper care it will last a lifetime.

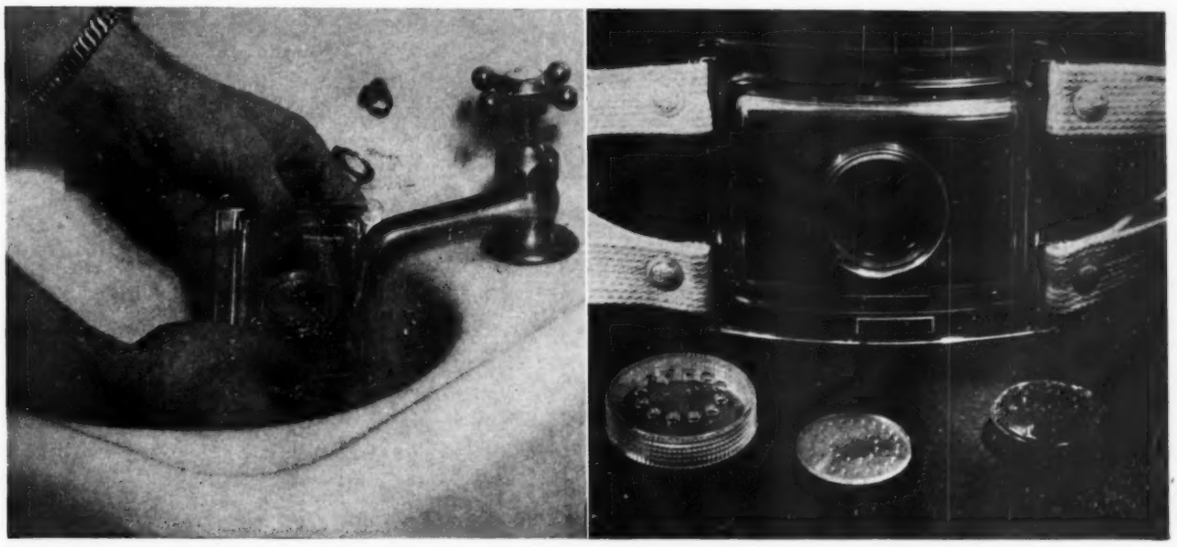

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FIG. 1. The colostomy protector is made of impervious plastic and is easily cleansed with soap and water.

FIG. 2. This shows the colostomy protector from the front. At the lower right is the changeable deodorizing element which fits in the center of the protector and is held in place by the screw cap shown at the lower left. In the lower center is the perforated plastic disc which can be used together with a small piece of cotton in place of the deodorizing filter if desired.

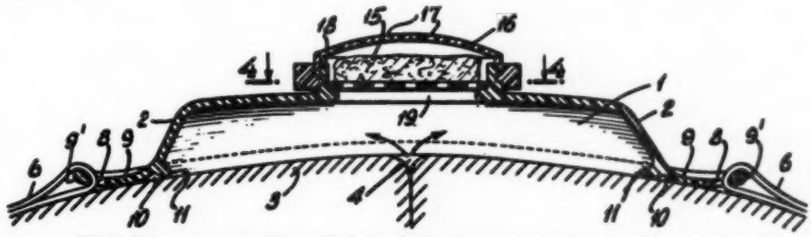

FIG. 3. This is a cross section of the colostomy protector showing the deodorizing filter (15) in place beneath the removable cap (17). It also illustrates the "seal" which makes the device water-tight. When the protector is in place, the skin projects into the groove (10) at the inner aspect of the base (9) thus providing a water-tight seal.

Some details of the shape of the protector, especially the edge which forms the water-tight seal, are of interest. In general it is a shallow container about 3/8 inch in depth and rectangular in shape when viewed from the front. (Fig. 2.) It is provided with gently sloping walls inclining inward toward the top and outward toward the margins. The rim of the rectangular chamber where it comes in contact with the body is not of strictly straight lines but is curved on arcs to fit the body contour. (Fig. 3, No. 9.) The outer flange of the protector is curled back as shown at the right and left of Figure 3 (No. 9), this curl going all the way around the protector. This upward curve of the rim and its smoothly rounded edge permit the wearer to bend freely and to take any normal posture without danger of chafing or cutting the skin. The slots into which the nylon elastic tapes (No. 6) are fastened, are located far enough up on this curled back rim so that the tapes are not pressed into the body.

At the inner side of the flange (No. 9) and under the base of the sloping wall (No. 2) of the chamber is a rounded groove (No. 10) which has no sharp edges but which creates a natural seal by reason of the skin projecting into the groove (No. 10). A rounded wall (No. 11) provides the primary or first seal which any liquid accumulating in the colostomy protector meets. Any liquid working past this point encounters the rounded groove (No. 10) or the second seal and finally the broad flange (No. 9) which is close against the skin and constitutes the tertiary or outer seal. This arrange-

ment of grooves and flanges provides a water-tight seal without skin irritation and therefore protects the patient from embarrassment caused by unexpected liquid discharges from the colostomy.

In order for the protector to function properly the colostomy opening must be placed near the midline. If the opening is near the iliac crest or the flank, the body contour is such that the protector will not fit and make a tight seal.

The patients wear the protector during the day but upon retiring substitute an elastic belt and a pad of soft cotton or gauze in order to give the skin about the colostomy a rest.

In summary, we have described a colostomy protector which is cheap, transparent and easily cleansed with soap and water under an ordinary faucet. It permits the escape of gas but not of odors and thereby removes one of the serious causes of embarrassment which a colostomy patient must face. It is not designed to be worn by a patient with a "wet" colostomy nor by patients with an untrained colostomy. It is designed for those patients who through the use of daily irrigation or other means have obtained control over their colostomy. Since it has a non-irritating, water-tight seal it adequately protects these patients from embarrassment caused by the unexpected discharge of liquid from the colostomy and permits them to resume a fairly normal life.

ALTHOUGH a pedunculated, isolated loop of intestine will make a suitable vagina in patients who do not have one either because of congenital absence or because it had to be removed by a surgeon, a simpler procedure is to make a cleft between the bladder and rectum and insert a suitable prosthesis covered with free skin grafts taken from the patient's thigh. Results are highly successful but one must be sure, in the congenital cases, that concomitant urologic defects are not also present. (*Richard A. Leonardo, M.D.*)

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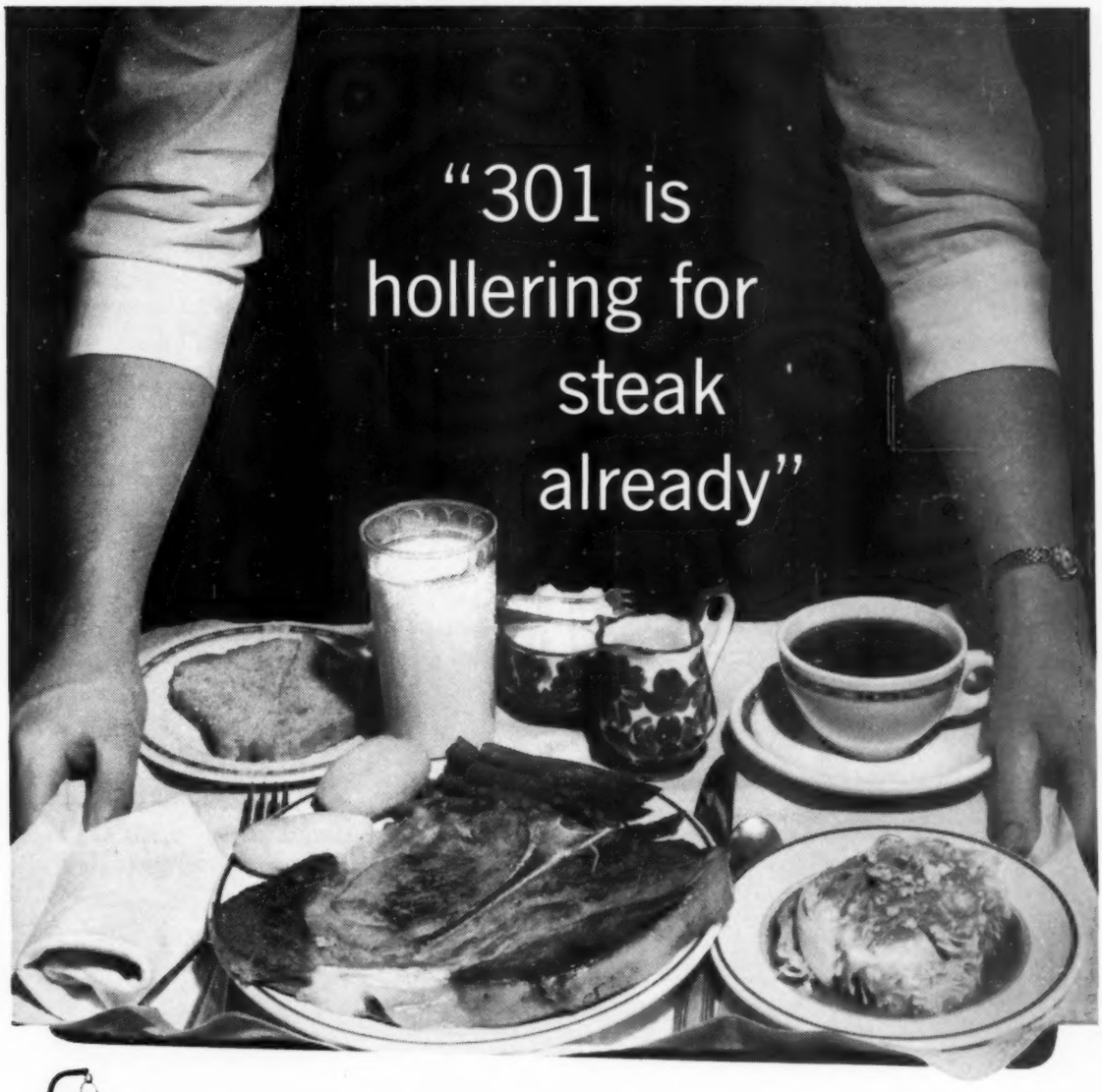

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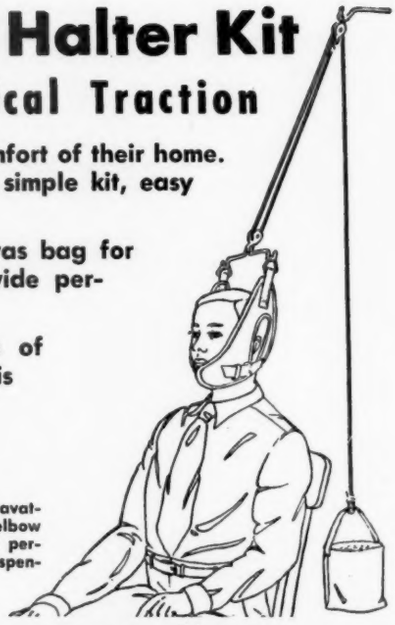

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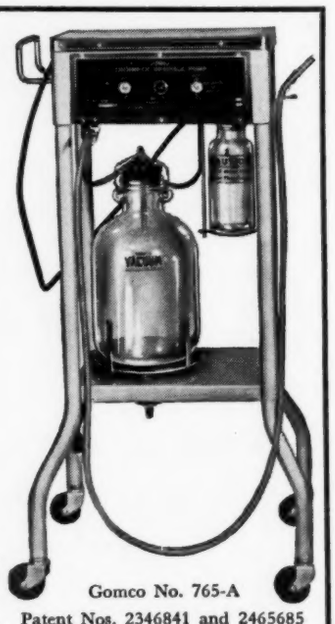

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*Combes, F. C.; Zuckerman, R., and Kern, A. B.: Chlorophyll in Topical Therapy, New York State J. Med. *52*:1025, 1952.

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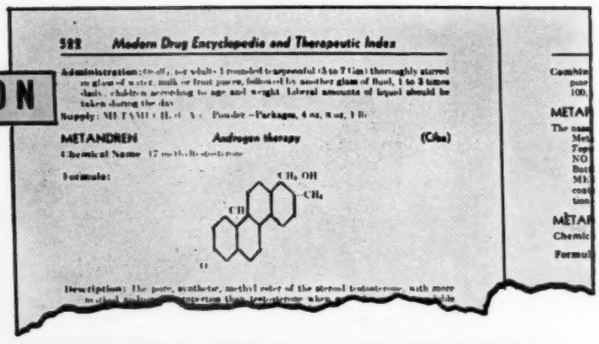

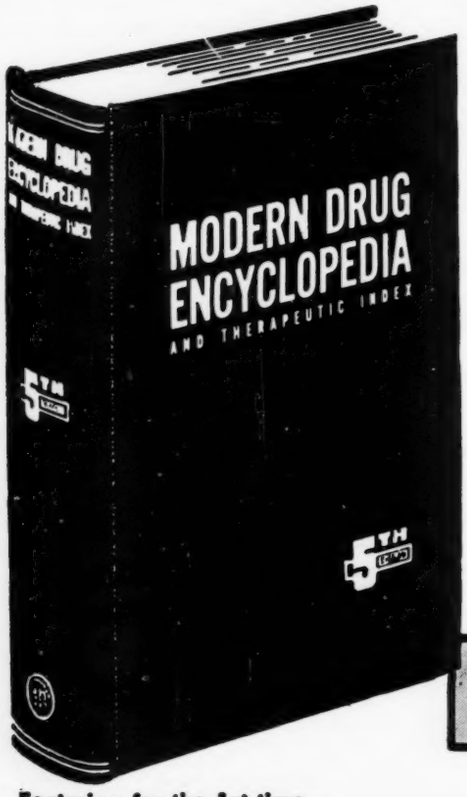

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THE XII Congress of the International Union against Tuberculosis and the II International Congress on Diseases of the Chest sponsored by the Council on International Affairs, American College of Chest Physicians, will be held in Rio De Janeiro, Brazil, August 24 to 30, 1952. Both Congresses will be held under the Presidency of Professor Manoel de Abreau; Dr. Reginaldo Fernandes will serve as General Secretary. The Honorable Getulio Vargas, President of Brazil, has accepted the Honorary Chairmanship of the Congresses.

Physicians wishing to present papers at the Rio Congresses on the subject of tuberculosis are requested to write to Professor Etienne Bernard, Secretary General, International Union against Tuberculosis, 47 Rue de Courcelles, Paris, France, and those wishing to present papers on non-tuberculous diseases of the chest (heart and lung) should communicate with Dr. Andrew L. Banyai, Chairman, Council on International Affairs, American College of Chest Physicians, 112 East Chestnut Street, Chicago 11, Illinois. For further information please write Mr. Murray Kornfeld, Executive Secretary, American College of Chest Physicians, 112 East Chestnut Street, Chicago 11, Illinois.

THE Sharp & Dohme Medical Research Laboratories at West Point, Pennsylvania, were dedicated on May 12, 1952. It was Professional Day. Dr. L. Earle Arnow, Director of Research, presided and the dedication was by John S. Zinsser, Chairman of the Board. A symposium of six papers was presented on Frontiers of Research on Blood and Plasma Extenders, moderated by Dr. I. S. Ravdin. After this session there were cocktails, a luncheon and inspection of laboratories. Sharp & Dohme issued an elaborate Press Book on this occasion, which is most interesting and instructive. Anyone who might desire this book should write to Public Relations Department, Sharp & Dohme, Inc., 640 North Broad Street, Philadelphia 30, Pa. Congratulations.

REPLICAS of America's three most famous documents, the Declaration of Independence, the Bill of Rights and the Constitution, have been made available at very low cost. These facsimiles are on genuine parchment paper, specially aged to look 175 years old and can easily be framed. They are ideal in the waiting rooms of doctors' offices or as an added touch to doctors' libraries. For further information write The American Journal of Surgery, 49 West 45th Street, New York 36, N. Y.

THE University of Illinois has started construction on a new classroom and laboratory building in the Medical Center District on Chicago's near West Side which will permit the Colleges of Pharmacy, Medicine and Dentistry to increase their enrollments.

The six-story structure, known as the East Unit of the Dentistry-Medicine-Pharmacy Building and to be occupied largely by the College of Pharmacy, will be located at Wood and Polk Streets.

When completed the new building will permit the University to accept a larger number of qualified students who otherwise could not gain admission. The number of applicants has far exceeded available places in recent years. The College of Medicine will be able to increase its registration from 166 to 190 students per class.

Funds totaling $5,540,000 were appropriated to the University of Illinois a year ago by the 67th General Assembly of Illinois for the construction of the building.

THE building of a new science building of the State University of New York, College of Medicine (New York City), will start this September. It will cost about $22,000,000 and will be close to the Kings County Hospital where 1,000 beds are allotted to the school for clinical teaching. The state medical school was formerly The Long Island College of Medicine.

(*continued on page 42*)

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J.A.M.A. April 21, 1951 p. 1238

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Outside the Ivory Tower

(*continued from page 40*)

PARKE, Davis & Company recently announced the establishment of a new branch at Santurce (San Juan), serving Puerto Rico, the Dominican Republic, Haiti and the Virgin Islands.

W. H. Bundesen of Detroit, Michigan, who is in charge of Latin-American affairs for the company, said, "Approximately 9,000,000 persons live in the territory of the new branch. Physicians and pharmacists now will be able to obtain Parke, Davis medicines in a matter of hours, instead of the weeks previously required for shipment."

He emphasized the new Puerto Rico branch "is very tangible evidence of our faith in the future of these countries."

THE National Gastroenterological Association again takes pleasure in announcing its Annual Cash Prize Award Contest for 1952. One hundred dollars and a Certificate of Merit will be given for the best unpublished contribution on gastroenterology or allied subjects. Certificates will also be awarded those physicians whose contributions are deemed worthy.

Contestants residing in the United States must be members of the American Medical Association. Those residing in foreign countries must be members of a similar organization in their own country. The winning contribution will be selected by a board of impartial judges and the award is to be made at the Annual Convention Banquet of the National Gastroenterological Association in October, 1952.

Certificates awarded to other physicians will be mailed to them. The decision of the judges will be final. The Association reserves the exclusive right of publishing the winning contribution and those receiving Certificates of Merit in its official publication, *The Review of Gastroenterology*.

All entries for the 1952 prize should be limited to 5,000 words, be typewritten in English, prepared in manuscript form, submitted in five copies accompanied by an entry letter and must be received not later than September 1, 1952. Entries should be addressed to the National Gastroenterological Association, 1819 Broadway, New York 23, N. Y.

DR. LEONARD J. GOLDWATER, Professor of Occupational Medicine at Columbia University's School of Public Health, has been appointed Consultant on Cardiac Rehabilitation to the Federal Office of Vocational Rehabilitation. He will advise on the setting up of new centers of job evaluation and placement for people with heart disease.

Dr. Goldwater started the Work Classification Unit at the Cardiac Clinic of Bellevue Hospital in 1941. It was the first such clinic in the world. Since then eight others, modeled after it, have been established in this country by local chapters of the American Heart Association.

DR. GEORGE WALTER McCOY, internationally known scientist and from 1915 to 1937 Director of the National Institute of Health, died April 2, 1952, in Washington, D. C., after a short illness. He was seventy-five years old.

One of the Nation's top authorities on leprosy, Dr. McCoy was also widely recognized for his contributions in such fields as plague, tularemia, psittacosis, postvaccination complications and biologics control. He entered the Public Health Service in 1900, headed the U. S. Plague Laboratory in San Francisco from 1908 to 1911 and was Director of the Leprosy Investigation Station in Hawaii from 1911 to 1915. In the latter year he became Director of the Hygienic Laboratory, later renamed the National Institute of Health. At that time the organization had less than 100 employees as compared with more than 600 when Dr. McCoy retired as Director in 1937.

THREE awards and three honorable mentions were presented to scientific exhibitors at the Fifth American Congress on Obstetrics and Gynecology in Cincinnati March 31 through April 4, 1952, sponsored by the American Committee on Maternal Welfare.

First place was given to "Genital Cytology" by W. Kenneth Cuyler, PH.D., Louise A. Kaufmann, B.A. and Bayard Carter, M.D., all of Duke University School of Medicine and Hospital, Durham, N. C. It consisted of smear slides correlated with the histologic findings as seen by the pathologist, using descriptive caption placards and 100 microscopes.

Second award went to "Fetal Salvage Program—Preconception Treatment Clinic" by Edward C. Hughes, M.D., Charles Lloyd, M.D.,

(*continued on page 44*)

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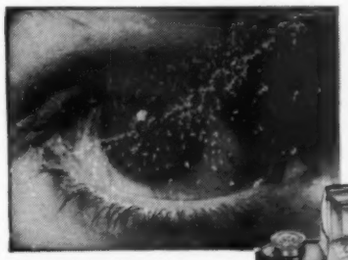

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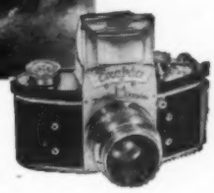

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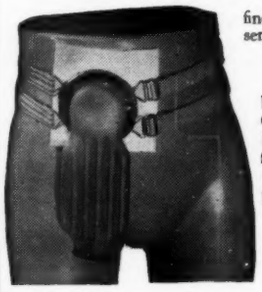

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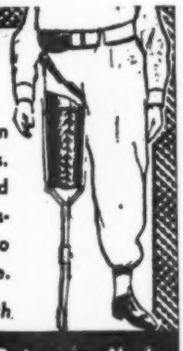

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Outside the Ivory Tower

(*continued from page 42*)

Ferdinand J. Schoeneck, M.D., Albert W. VanNess, M.D. and Miss Stella Zimmer, the photographer, all of Syracuse, N. Y. It was sponsored jointly by the College of Medicine, State University of New York at Syracuse; the Syracuse Department of Health; and the New York State Department of Health. The exhibit stressed prematurity, chronic abortion and fetal anomalies.

Third place winner was "Pathology of Perinatal Death" by George W. Anderson, M.D., Trent Busby, M.D. and Robert Nesbitt, M.D. of Johns Hopkins Hospital, Baltimore. The pathology of anoxia, birth injury, congenital malformation and hyaline membrane were shown in color transparencies.

CHANCES of survival to and through the main working ages of life are best in the United States, Western Europe and the English-speaking countries elsewhere, Metropolitan Life Insurance Company statisticians report. Survivorship experience in these countries is much more favorable than in the lesser developed areas of the world.

"Easing of the burden that premature death places on the underdeveloped areas is one of the most important tasks facing the World Health Organization and the individual governments," the statisticians assert. "It is in these areas, where the productive capacity of the people must be increased if their living standards are to be raised, that men have the smallest chan es of living through their main productive years. In wide areas of the world less than half the males reaching age 15 will still be alive at 65."

FREDERICK H. FALLS, M.D., Chicago, Ill., was elected president of the American Committee on Maternal Welfare at a meeting of directors and delegates from member organizations in Cincinnati April 3rd. He succeeds Fred L. Adair, M.D., Maitland, Fla., who had been president since the American Committee was incorporated in 1934. Dr. Adair also was one of the founders and key figures of the Joint Committee on Maternal Welfare, formed in 1919, which eventually broadened into the present organization.

Bayard Carter, M.D., Durham, N. C., was re-elected vice-president. Ann Kirchner, R.N., Chicago, Ill., was elected secretary and Francis Ford, M.D., Rochester, N. Y., treasurer.

Three new directors were elected to fill vacancies on the Board: R. L. Cleere, M.D., executive director, State of Colorado Department of Public Health, Denver; Ruth Doran, R.N., Children's Bureau, Washington, D. C.; and Hilda Kroeger, M.D., administrator, Elizabeth Steele McGee Hospital, Pittsburgh Pa.

The executive committee of the Board will now include the four officers, Dr. Cleere and Howard C. Taylor, M.D., New York City.

DR. CHARLES D. MARPLE has been appointed Medical Director of the American Heart Association, it was announced recently by Dr. Louis N. Katz, Association President. Dr. Marple has been Assistant Clinical Professor of Medicine at the University of California School of Medicine, San Francisco, since 1950.

In his new position Dr. Marple will administer the research policies and scientific program of the American Heart Association, as developed by the Association's Scientific Council, and will also be responsible for conducting the program of physician education.

DR. ALFRED ULLMAN, who was graduated from the College of Physicians and Surgeons, Baltimore, in 1902, marks his fiftieth year in the private practice of surgery. Not long after his graduation he became Professor of Anatomy and Clinical Professor of Surgery at the College of Physicians and Surgeons.

He has trained many men who are now outstanding. Dr. Ullman founded and endowed a magnificent research laboratory at the Sinai Hospital which has been the source of numerous scientific papers. He has always understood the important part which research plays in Medicine and Surgery.

Dr. Ullman served as Surgeon-in-Chief to the Sinai Hospital from 1928 to 1945.

THE resignation of Dr. Shields Warren as Director of the U. S. Atomic Energy Commission's Division of Biology and Medicine and the appointment of Dr. John C. Bugher as his successor were announced today by M. W. Boyer, AEC General Manager. Dr. Warren's resignation as Division Director is effective June 30, 1952, but at that time he will become a member of the AEC's Advisory Committee for Biology and Medicine.

(*continued on page 46*)

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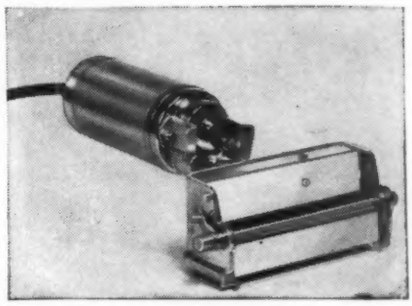

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Outside the Ivory Tower

(*continued from page 44*)

EXTRAORDINARY progress has been made since the turn of the century in reducing mort lity in our country. A number of infections, such as typhoid fever and the principal communicable diseases of childhood, have been all but wiped out as causes of death. The death rate from tuberculosis has been cut by about 90 per cent since 1900, and the record for pneumonia is not much less impressive. Largely as the result of the epoch-making advances in medical science and the wide expansion of the public health program, the chances of dying prematurely have been greatly reduced. At the beginning of the century only three-quarters of the newborn in our country reached the age of twenty-four; in 1949 the same proportion survived more than sixty years. The age to which one-half of the newborn survive has advanced in this period from fifty-eight years to past seventy-two years.

DR. H. HOUSTON MERRITT, Professor of Neurology at Columbia University and Director of the Neurological Service of the Neurological Institute of Presbyterian Hospital, has been appointed to the Advisory Committee on Virus Research and Epidemiology of the National Foundation for Infantile Paralysis, it has been announced by Basil O'Connor, President of the March of Dimes organization.

DR. JOSE RODRIGUEZ DELGADO, Research Fellow in Physiology at the Yale School of Medicine, won the 1952 Ramon y Cajal Prize, the top scientific prize given by the Spanish government. Dr. Delgado, who has been on leave from the University of Madrid since 1950 to work at Yale, won the prize for his paper on a new technic for brain study. By means of this technic he implants electrodes inside the brain of laboratory animals, such as monkeys, to study the functions of the brain, all aimed at establishing a physiologic method of treating mental disease. The Ramon y Cajal Prize, which also carries an honorarium of about $1,000, was established by Spain in honor of the late Dr. Santiago Ramon y Cajal who died in 1934. He was a co-winner in 1906 of the Nobel Prize for his work on the structure of the nervous system. The prize competition is open to all Spanish scientists who must submit papers on original research conducted during the year.

AN ultrahigh precision microtome, designed to cut sections of biologic tissue to a thickness of five-millionths of an inch, has been developed by Battelle Institute, Columbus, Ohio. Tissue sections of this thickness are as much as one-tenth as thick as those that can be cut with the conventional microtome. They are thin enough to be photographed in the electron microscope which provides about 100 times the useful magnifying power of the light microscope. The new microtome is expected to enable fullest use of the electron microscope in studying the cell structure of plant and animal tissue. It may also be useful in studies of synthetic and natural fibrous materials. The American Instrument Company, Silver Spring, Maryland, has been licensed to manufacture it.

WITH Spring here, husbands who face such seasonal chores as taking down the storm windows, putting up the screens and awnings, and shaking rugs out of windows, are warned to approach these tasks cautiously. This warning is from the safety experts of the Metropolitan Life Insurance Company, who point out that falls from windows are responsible for about 500 deaths yearly in the United States.

In the insurance company's experience among millions of industrial policyholders, the statisticians report that about four-fifths of all fatal falls from windows occur in the home. The remainder are in such varied places as hospitals, office buildings, department stores and industrial plants.

By far the greatest number of the home fatalities were among adults. Although the mishaps occur in every month of the year, they are most frequent in the summer when windows are most likely to be open. Of the accidents which happened to children in the insured group, eleven of 16 lost their lives during the three months of June through August. Ten of the children involved in these summer accidents were three years of age or under, which underscores the hazard of leaving toddlers unsupervised near open windows. Twelve of the adults fatally injured were washing windows, and some of these victims momentarily lost their balance when the window jammed and could not be moved.

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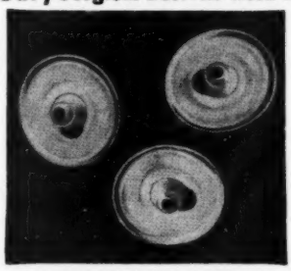

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